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THE PORT OF NEW YORK AUTHORITY

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SECOND PROGRESS REPORT
ON
HUDSON RIVER BRIDGE
AT NEW YORK BETWEEN
FORT WASHINGTON AND FORT LEE

MARCH 1929

75 WEST STREET, NEW YORK CITY

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New Jersey

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Bureau of Public Information

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L. I. Shelley
Attorney

Charles Horowitz
Attorney

REAL ESTATE

H. S. Quigel
Land Agent

E. Tracy Lanterman
Land Agent

Direct
J
24 July 1929

THE PORT OF NEW YORK AUTHORITY

BRIDGE DEPARTMENT

STAFF

O. H. Ammann
Chief Engineer of Bridges

Edw. W. Stearns
Assistant to Chief Engineer of Bridges

Robert A. Lesher
Highway Traffic Engineer

Montgomery B. Case
Engineer of Construction
Hudson River Bridge

J. C. Evans
Engineer of Bridge Terminals

R. S. Johnston
Engineer of Research and Tests

A. Andersen
Assistant Engineer of Design

R. Hoppen, Jr.
Resident Engineer, Hudson River Bridge—New York Section

F. E. Cudworth
Resident Engineer, Hudson River Bridge—New Jersey Section

Allston Dana
Engineer of Design

Wm. J. Boucher
Engineer of Construction
Kill van Kull Bridge

H. J. Baker
Engineer of Steel Inspection

A. W. Munsell
Engineer of Masonry Inspection

W. A. Cuenot
Chief Draftsman

R. T. Robinson
Resident Engineer
Kill van Kull Bridge

Homer S. Seely
Resident Engineer, Hudson River Bridge—Central Section

ARCHITECTS

Cass Gilbert
Architect, Hudson River Bridge and Kill van Kull Bridge

York & Sawyer
Architect, Arthur Kill Bridges

CONSULTANTS

William H. Burr
Consulting Engineer

Daniel E. Moran
Consulting Engineer on Foundations

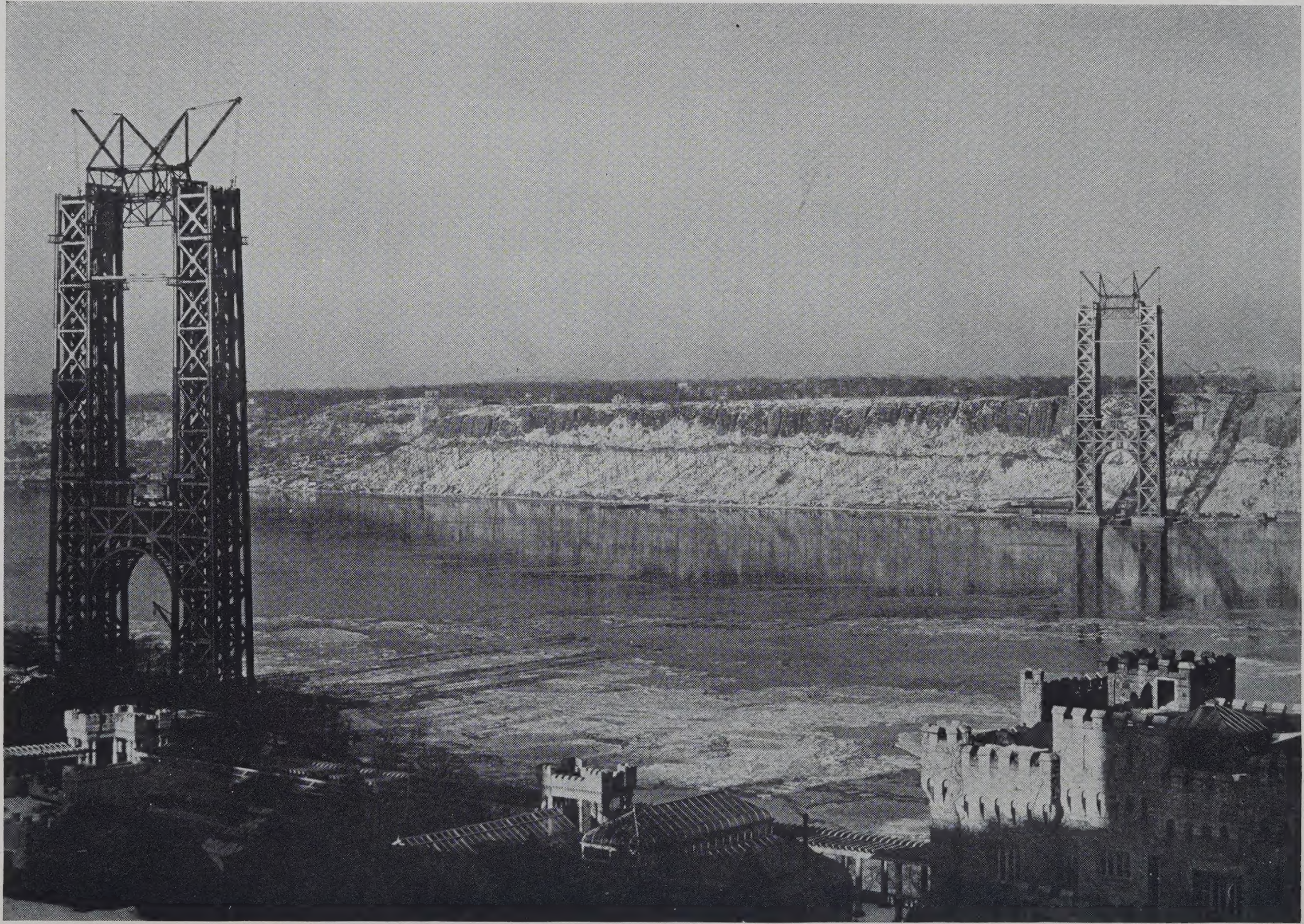
Joseph B. Strauss
Consulting Engineer

Waddell & Hardesty
Consulting Engineers

Leon S. Moisseiff
Advisory Engineer of Design

Lewis Buckley Stillwell
Consulting Electrical Engineer

Prof. Chas. P. Berkey
Consulting Geologist



VIEW OF HUDSON RIVER BRIDGE TOWERS, LOOKING TOWARD PALISADES, NOVEMBER 12, 1928

March 22, 1929

To the Commissioners of The Port of New York Authority

Gentlemen:

On January 20, 1928, there was submitted to you the first report on the progress in constructing the Hudson River Bridge—a project committed to the Port Authority by legislation of the States of New York and New Jersey.

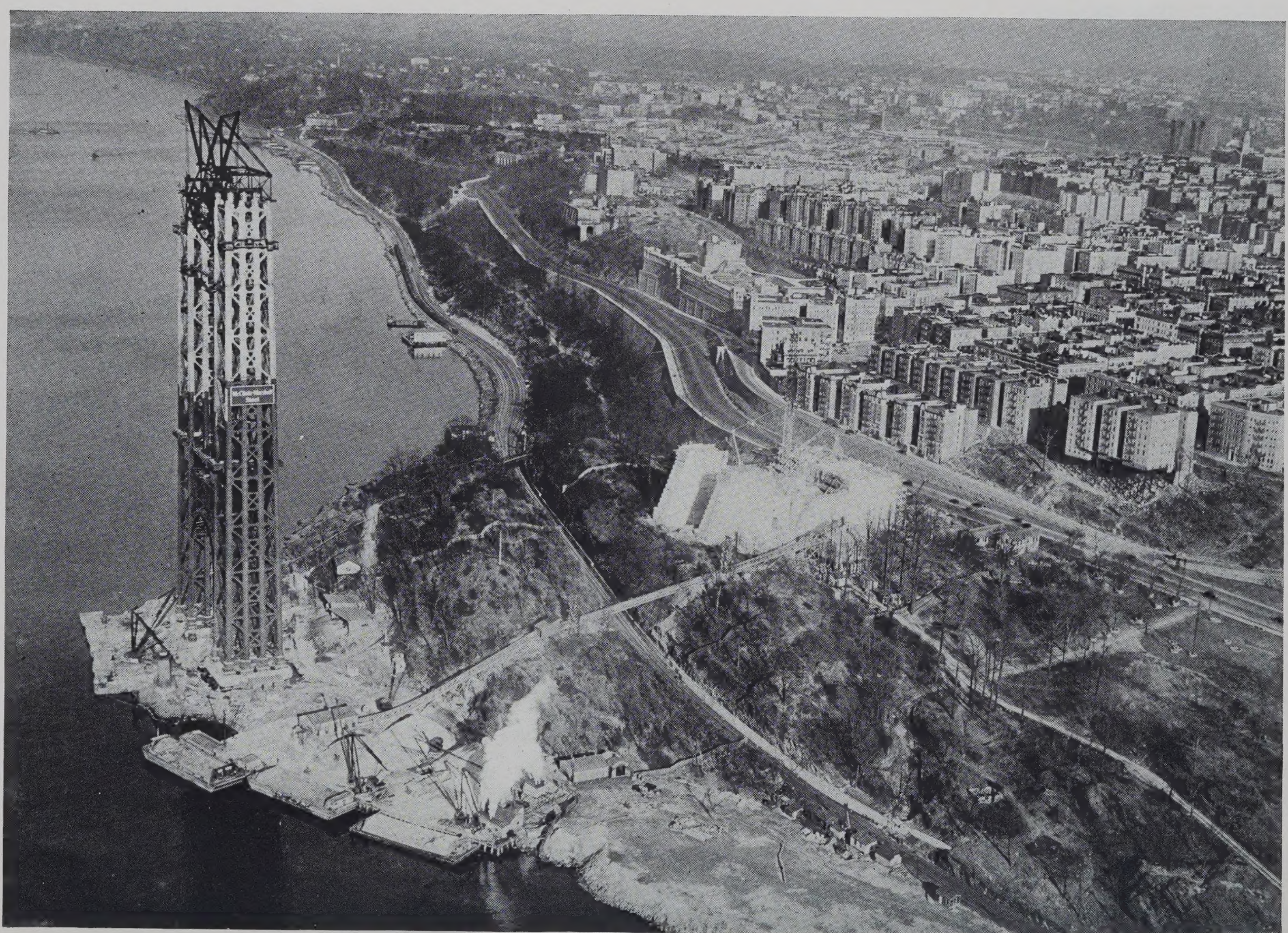
The Chief Engineer of Bridges has now submitted a second report which outlines the progress made thus far. His report is transmitted herewith.

The work has been carried on to date with proceeds of the first issue of Twenty Million Dollars Port of New York Authority Gold Bonds, which were sold December 9, 1926, and the sum of Two Million Five Hundred Thousand Dollars which has been advanced by the States of New York and New Jersey as their part of agreed aggregate advances of Ten Million Dollars. A total bond issue of Sixty Million Dollars has been authorized for this work. The bonds will be amortized and the States' advances repaid through tolls collected.

The construction work has progressed with signal success and a brief summary thereof will be found in the beginning of the Chief Engineer's report. We continue with the acquisition of property required for the approaches and up to this time ninety per cent. has been secured at amounts well within the original estimates.

Yours very truly,

J. E. Ramsey
Chief Executive Officer



AEROPLANE VIEW OF NEW YORK AND ANCHORAGE, DECEMBER 22, 1928

SECOND PROGRESS REPORT

ON

HUDSON RIVER BRIDGE

BY THE CHIEF ENGINEER OF BRIDGES

March 1, 1929

MR. J. E. RAMSEY, *Chief Executive Officer*

DEAR SIR:

Since the First Progress Report was rendered on January 3, 1928, very substantial and satisfactory progress has been made in the construction of the Hudson River Bridge between Fort Washington and Fort Lee.

Early in the year the unusual and difficult foundation work for the New Jersey tower, which had been under way since the summer of 1927, was brought to successful completion in time for the scheduled erection of the steel tower.

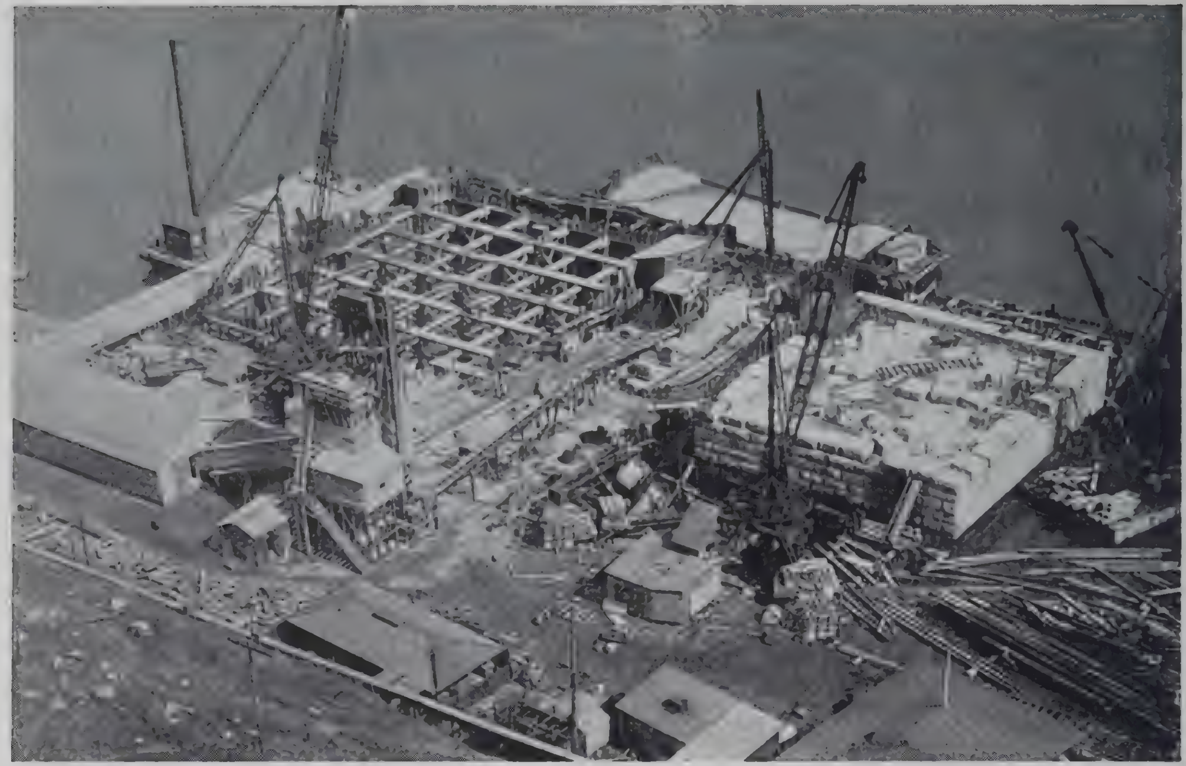
A contract for the construction of the tower base on the New York side, a comparatively simple operation of building two huge concrete blocks on rock above water, was let in May and was speedily completed within two months.

Rolling of steel for the two towers, embracing 40,000 tons, began late in 1927, within two months after the contract was awarded, and throughout the year 1928 fabrication of the steelwork proceeded continuously at three of the largest bridge shops. Work on the erection of the towers began in June, 1928, and so intensively was this work carried on that within four and a half months 31,000 tons of steel had been erected and the towers had reached a height of 500 feet, or about five sixths of their total height. Erection work was stopped at this point inasmuch as it was not considered advisable to work in the open at such great height during the winter months. In the meantime, however, fabrication of the balance of the steelwork proceeded uninterruptedly at the shops and will be ready for the resumption of the erection in the early spring.

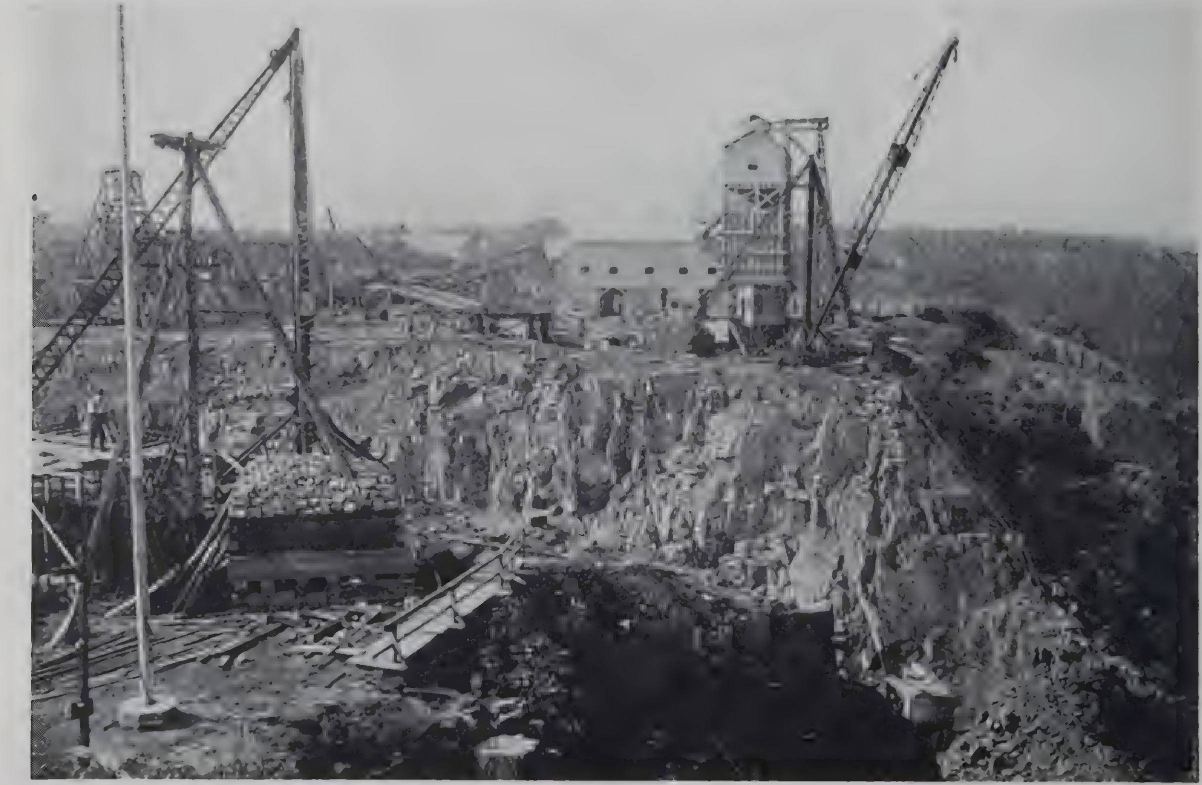
While construction of the towers proceeded intensive work was done also on the anchorages. Since the summer of 1927, and throughout 1928, the excavation of 200,000 cubic yards of hard traprock for the New Jersey anchorage and approach has been progressing steadily and is now practically completed.

On May 4, 1928, a contract was let for the excavation for and the building of the huge masonry blocks forming part of the New York anchorage in Fort Washington Park and involving the placing of approximately 110,000 cubic yards of concrete. Excavation for this anchorage was started last summer and so efficiently has this work and the concreting been carried on that nearly 100 per cent. has already been completed several months ahead of the stipulated time.

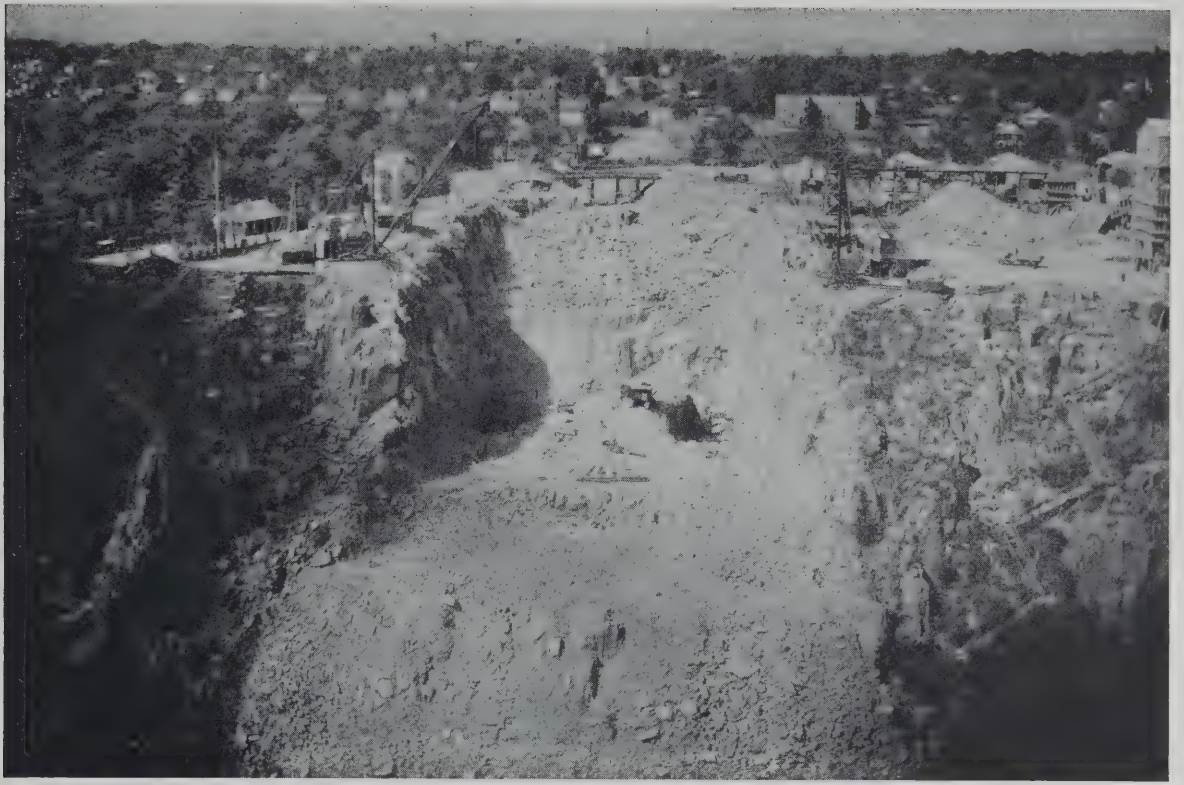
The steel anchorage and anchor chains for the cables, as parts of the cable contract,



NEW JERSEY FOUNDATION, MARCH 16, 1928—VIEW OF PIER AND COFFERDAM AND CONSTRUCTION PLANT



ROCK OUT—NEW JERSEY APPROACH, JULY 20, 1928—TYPICAL TRAP ROCK FORMATION—CRUSHER PLANT IN BACKGROUND



ROCK CUT SEEN FROM NEW JERSEY TOWER, SEPTEMBER 27, 1928—ANCHORAGE PITS AND TUNNELS IN CENTER OF PICTURE

were placed and solidly embedded as the work of building up of the concrete anchorage block on the New York side proceeded.

The steel anchorage on the New Jersey side is now being erected in the tunnels excavated into the rock.

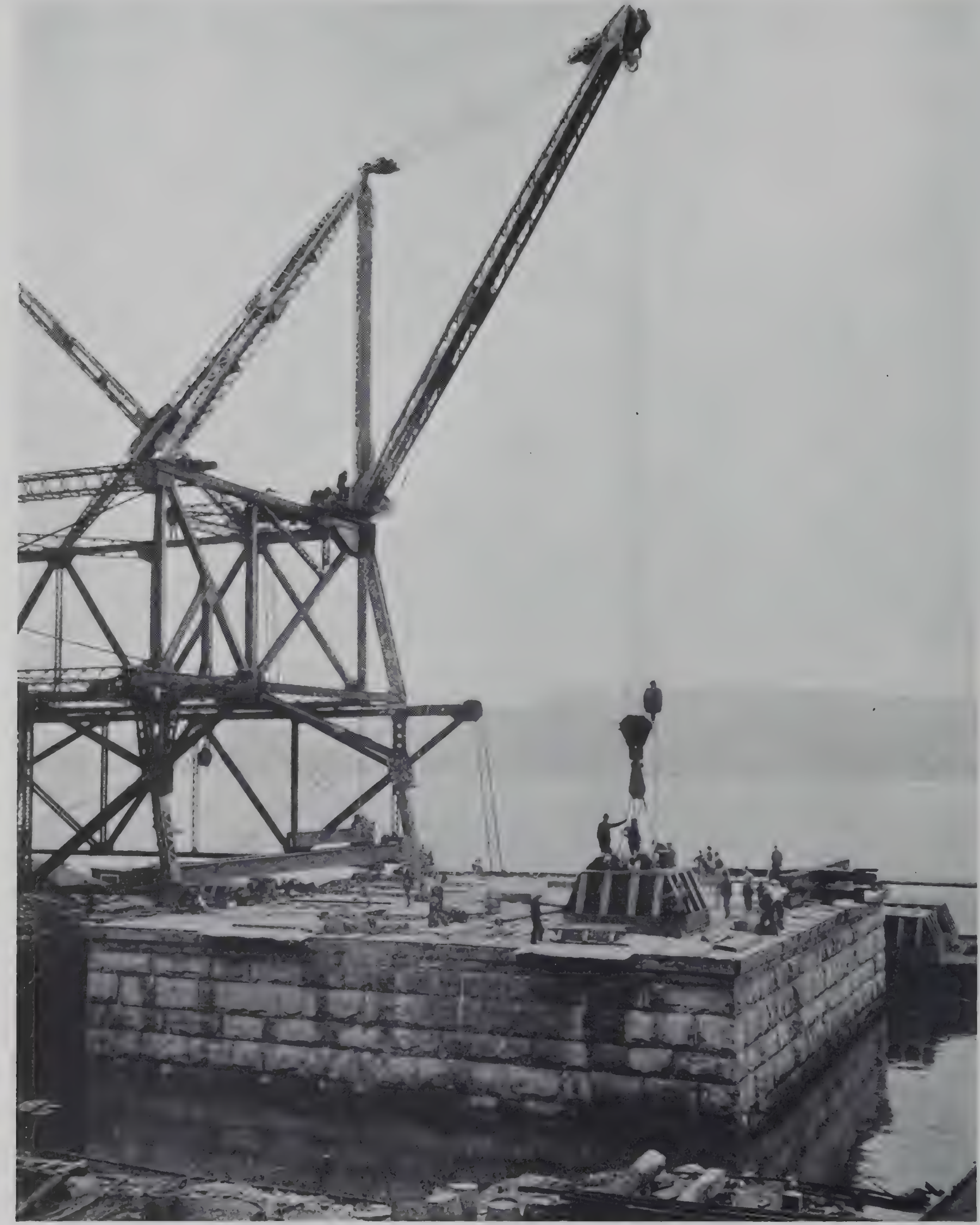
Fabrication of the 29,000 tons of high tension steel wire for the four cables has been proceeding continuously since February, 1928, and over one-third is now fabricated and stored at the plant. The contractor has made elaborate preparations for the spinning of the cables in place, which is scheduled to begin this summer.

Property for the two approaches to the extent of 90 per cent. has been acquired and negotiations have been concluded with the City of New York with respect to property occupied in Fort Washington Park.

Throughout the year further intensive study has been given by the staff, in collaboration with the architect and with the various contractors, to all details of the design and the preparation of the numerous working drawings.

Further study has also been given to the planning of the important approaches in co-operation with representatives of the City of New York, the Borough of Fort Lee, Bergen County and the State of New Jersey.

The field division of the Staff has been engaged in triangulations, topographical surveys



COMPLETED PIER OF NEW JERSEY TOWER, JUNE 23, 1928—ERECTION TRAVELER SETTING FIRST COLUMN BASE and preparation of property maps, as well as in painstaking supervision and inspection of all construction work.

Unusually thorough inspection has been exercised over the manufacture of all materials that go into the bridge. In addition, research work to gain further knowledge regarding certain parts of the structure has been carried on by the Staff, partly in collaboration with the U. S. Bureau of Standards and the U. S. Bureau of Public Roads.

All operations have been proceeding well within schedule and within estimated costs. If no unforeseen delays occur, the date of estimated completion and opening to traffic of the bridge in the spring of 1932 may be confidently anticipated.

The following gives a more detailed account of the work accomplished.

STUDIES OF TRAFFIC AND REVENUE

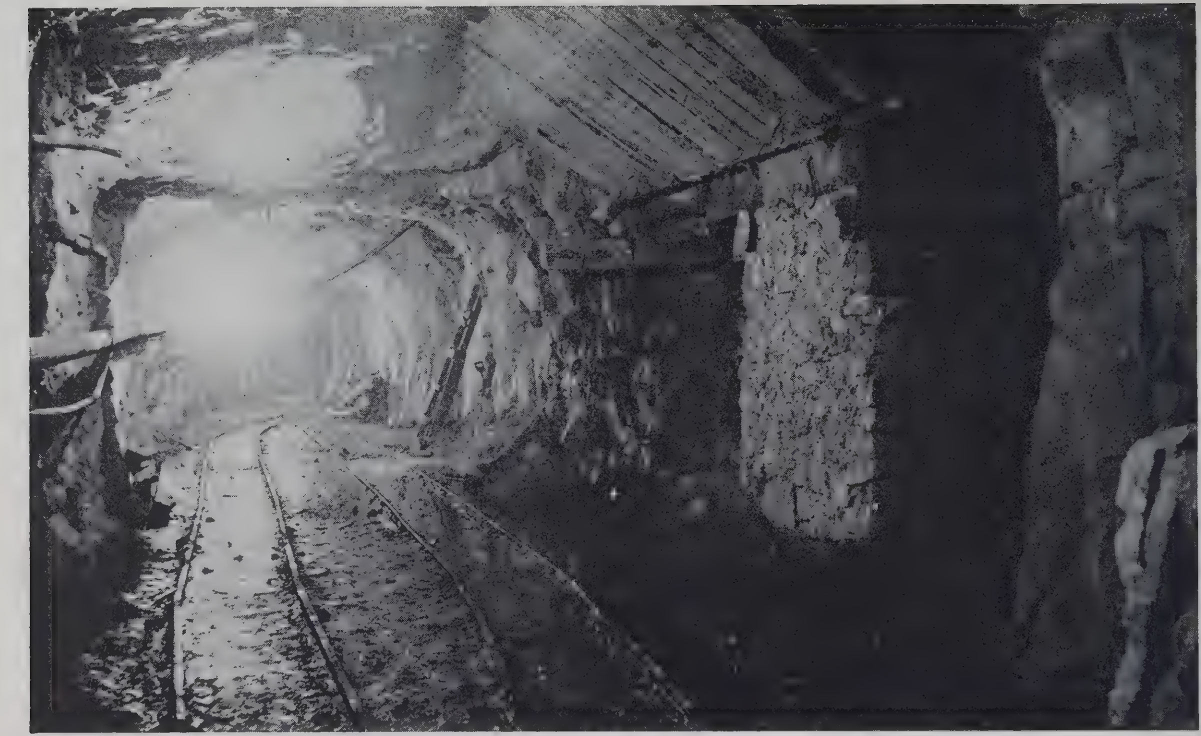
The estimates of traffic, as presented in the Tentative Report of February 25, 1926, and in the First Progress Report of January 3, 1928, were based upon traffic counts during the summer and fall of 1925. It was considered essential to keep checking these estimates currently by ascertaining the volume of vehicular and pedestrian traffic over each of the seventeen ferries crossing the Hudson River, and by estimating the amount of this traffic which the bridge will attract.

The amount of traffic carried by the crossings over the Hudson River from the Battery to Tarrytown has been obtained currently through the courtesy of the officials in charge of the ferries and the Holland Tunnel, and from these records the total amount of vehicular and pedestrian traffic, its rate of growth, and its fluctuations have been ascertained. A further special clocking of traffic was made in October of this year to ascertain the origin and destination of the largest amount of traffic nearest the bridge site, namely that carried by the Fort Lee Ferry at 125th Street.

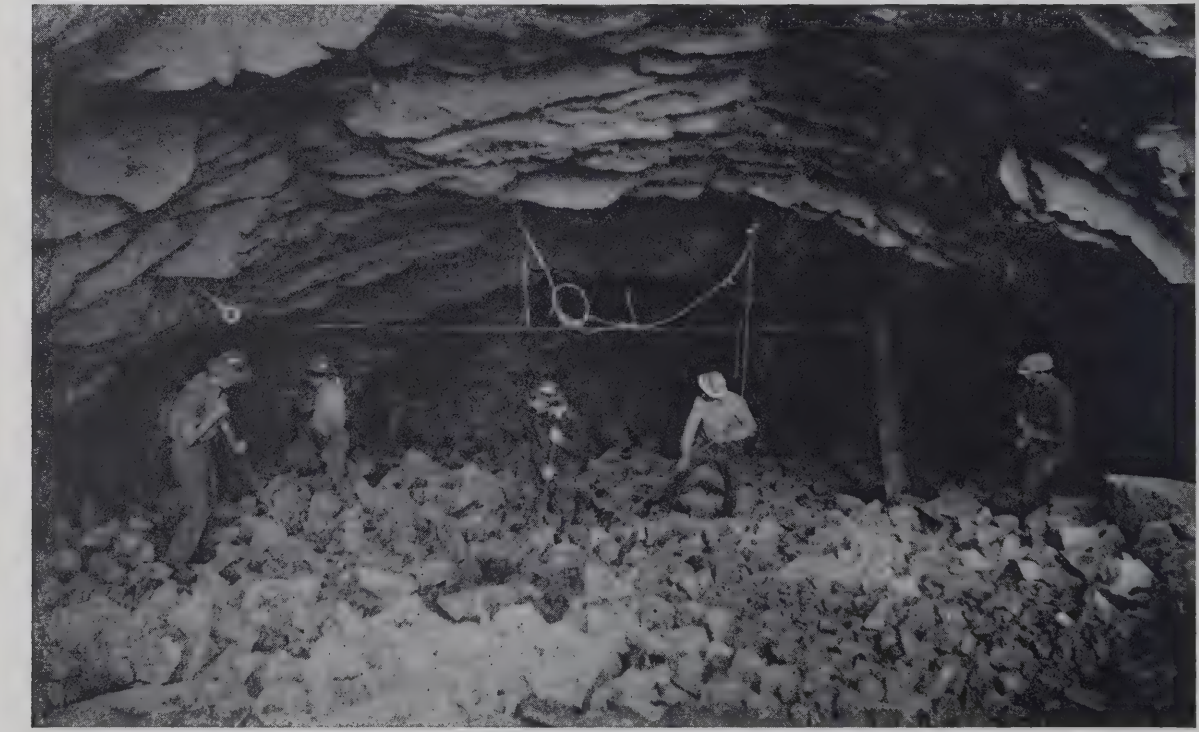
Following are presented the figures of the total actual vehicular traffic which crossed the Hudson River between the Battery and Tarrytown in 1925, 1926, 1927 and 1928, respectively, and a comparison with the estimates for these years made in 1925:

Year	*1925 Estimate*	*Estimated Per Cent. of Yearly Increase*	*Actual Hudson River Vehicular Traffic*	*Actual Per Cent. of Yearly Increase*	*Difference between Actual and Estimated Traffic*
1924	11,706,000				
1925	12,912,000	10.3%	12,589,333		− 322,667
1926	14,185,000	9.9%	13,736,436	9.1%	− 448,564
1927	15,510,000	9.3%	16,085,670	17.1%	+ 575,670
1928	16,887,000	8.9%	20,734,542	28.9%	+3,847,542

These figures indicate that the 1925 estimates were conservative and corroborate the conclusions reached to the effect that the anticipated revenues from reasonable tolls will



HORIZONTAL CROSS TUNNEL AT BOTTOM OF ANCHORAGE TUNNELS, DECEMBER 10, 1928—BOTTOM OF THE VERTICAL SHAFT IS IN THE BACKGROUND AND ON THE RIGHT ARE CONNECTIONS WITH ANCHORAGE TUNNELS



WORKING IN ANCHORAGE TUNNEL, SEPTEMBER 5, 1928—BLASTED ROCK IS DRAWN OFF BY GRAVITY INTO MUCK CARS IN CROSS TUNNEL be sufficient to meet operating expenses and fixed charges the first year after opening of the bridge to traffic.

DESIGN STUDIES, WORKING PLANS AND SPECIFICATIONS

In view of the importance of the structure and in line with the practice followed in connection with the planning of all Port Authority bridges, the Staff, in collaboration with the architect, has given repeated and exhaustive study to all features and details of the design. Although bids were invited and the contracts for the steelwork let on the basis of carefully developed detail plans and stress sheets, these plans and calculations were gone over and checked completely in collaboration with the contractors, who were required to prepare their own detail drawings and have them approved before proceeding with their shop or working drawings.

The benefit from this careful preliminary planning was indicated by the unusual expediency with which the contractor for the towers was enabled to prepare the large number of shop drawings and by the prompt beginning of rolling and fabrication of steel within two months after the contract was awarded.

The contractors' working drawings, as well as their carefully prepared erection plans for the towers, cables and anchorages, received minute examination on the part of the Staff.

In collaboration with the Legal Department the Staff of the Bridge Department prepared elaborate contract forms and specifications for all construction work.

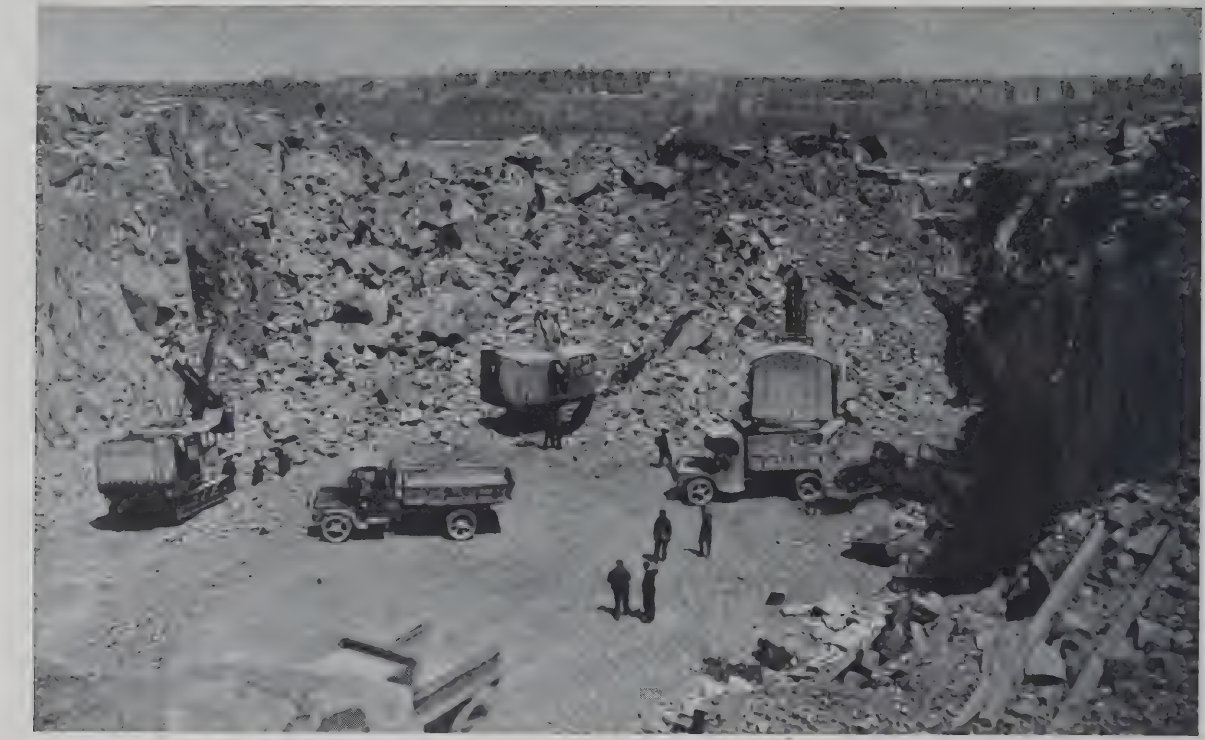
STUDIES OF APPROACHES AND HIGHWAY CONNECTIONS

Further detailed studies have been carried on throughout the past year in the development of the plans for the approaches and highway connections of the bridge at both ends.

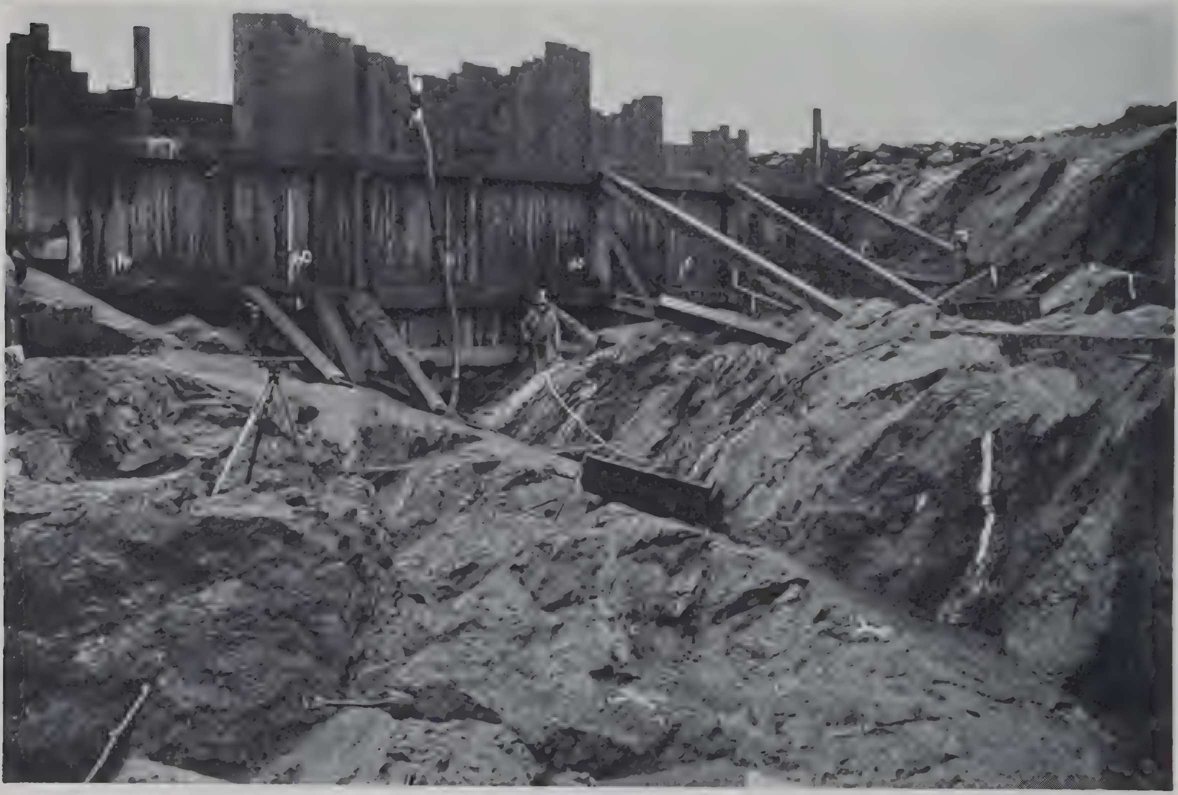
Through the organization of committees the Staff has had the benefit of the advice and cooperation of engineering representatives of the City of New York, the Borough of Fort Lee, Bergen County and the State of New Jersey.

On the New York side where the existing streets are flanked with expensive structures and where the City is confronted with the difficult problem of facilitating the movement of vehicular traffic the planning of proper approaches and street connections has been a complicated and laborious task. A plan has now been worked out, however, in sufficient detail to prove its practicability, which is believed to solve adequately this intricate problem and to be entirely satisfactory both to the City of New York and to the Port Authority.

A similar effective plan to avoid congestion and traffic interference is now in process of solution for the New Jersey end of the bridge. Here the conditions are quite different in that the existing streets are not flanked with expensive structures, as in Manhattan, and call for extensive improvement of the existing streets and the construction of new highways by the State, county and borough. The Port Authority is collaborating in the planning of these new improvements, more particularly their connections with the bridge approach.



EXCAVATING IN ROCK CUT, JULY 31, 1928—MATERIAL IS HAULED TO CRUSHER PLANT IN TRUCKS OR HOISTED OUT BY DERRICKS



ROCK SURFACE FOR NEW YORK TOWER FOUNDATION, MAY 26, 1928

SURVEYS AND MAPPING

During the past year surveying corps have been maintained on both sides of the river which have carefully checked and rechecked by triangulation across the river the distance between the towers. They have also surveyed and plotted all of the property upon which, and contiguous to which, the bridge and approaches are located. A large amount of topographical surveying and mapping has also been done to enable the accurate planning of the approaches.

INSPECTION, TESTING AND RESEARCH WORK

The Port Authority maintains a well-organized force for the testing and inspection of all materials which are used in its structures.

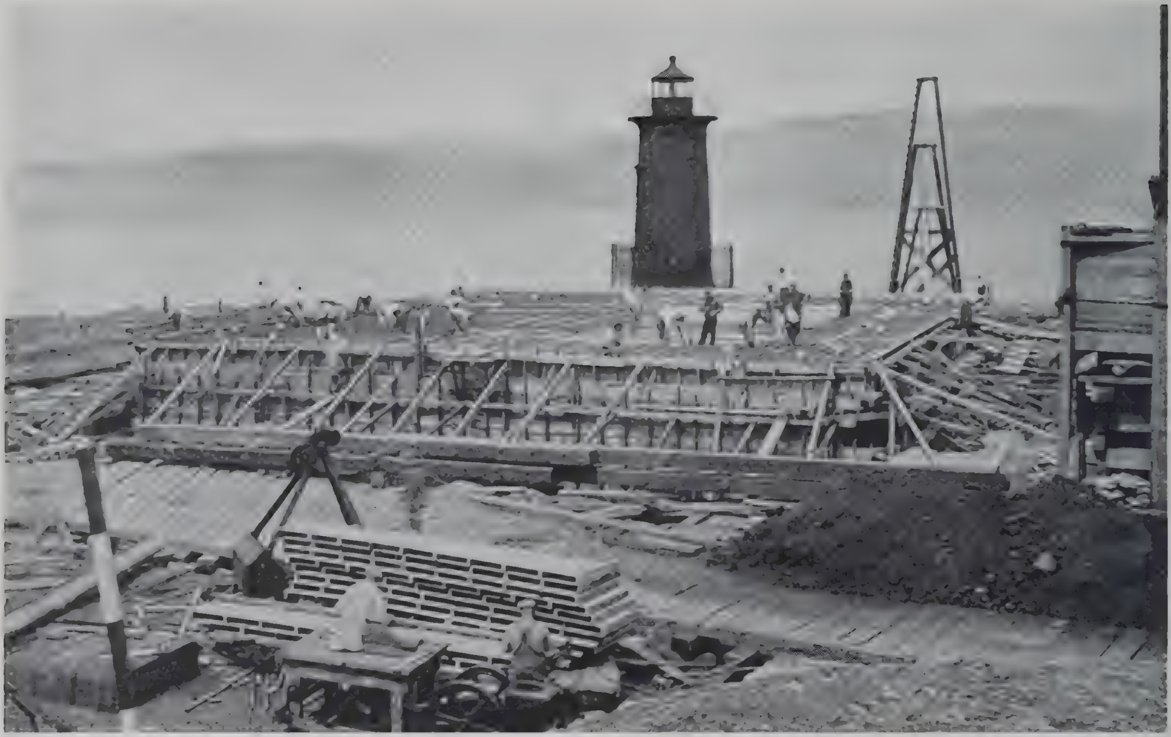
Inspectors are stationed at, or sent to, the various mills and shops where steel is being rolled and fabricated, the cement mills, the sand and gravel banks, the granite quarries and the many other places where materials are produced or fabricated. Numerous strength tests of the steel are made at the mills. All cement and concrete are tested at the laboratory maintained by the Port Authority in Jersey City, where many of the materials are also analysed chemically. By careful preliminary tests made with materials used in the work, and by frequent check tests on the concrete as it was poured, very close control of the concrete has been maintained throughout. This control has resulted not only in uniformly good results but has effected an appreciable saving in money.

Besides this routine inspection and testing of materials the Staff is conducting certain research work and special tests and stress measurements in order to study the suitability of various types of construction and to gain further knowledge regarding the actual stress conditions in the various members of the bridge in comparison with the theoretical action. In collaboration with the Federal Bureau of Public Roads, the Staff is making extensive tests of a number of different concrete floor slabs and in cooperation with the Federal Bureau of Standards it is conducting tests on large size steel columns representing members in the bridges.

Stress measurements are being made in the actual structure as the erection proceeds. In a structure of the magnitude of the Hudson River Bridge it is desirable thus to verify the theories upon which the design is based, and it is expected that these special investigations will develop results of value not only to the Port Authority, in the form of knowledge regarding this particular structure, but also will be of general scientific importance.

ACQUISITION OF PROPERTY

The right of way for the approaches to the bridge requires the acquisition of a total of approximately twenty-six acres of property, about eighteen acres in Fort Lee, New Jersey, and eight acres in Manhattan. In Manhattan practically all of the required property, except that west of Riverside Drive, is solidly built up with apartment houses, churches and stores, while in Fort Lee a large portion is either undeveloped or improved with inexpensive buildings.



FORMS AND REINFORCEMENT FOR NEW YORK TOWER FOUNDATION, JUNE 25, 1928

EXCAVATING FOR NEW YORK ANCHORAGE FOUNDATION, JULY 31, 1928—RIVERSIDE DRIVE IN RIGHT FOREGROUND

Of the property required in Manhattan, 88 per cent. has so far been acquired. The apartment houses and stores which have been acquired in the purchase of the property have been continued in operation and a large proportion of them will be occupied until it is necessary to proceed with the demolition. All of the properties have been acquired through negotiation and to date it has been entirely unnecessary to resort to condemnation. Early in the year negotiations were concluded with New York City for the acquisition of the property in Fort Washington Park on which the New York tower and anchorage are placed. These negotiations also involved the temporary use, necessary for construction purposes, of the park property surrounding these structures.

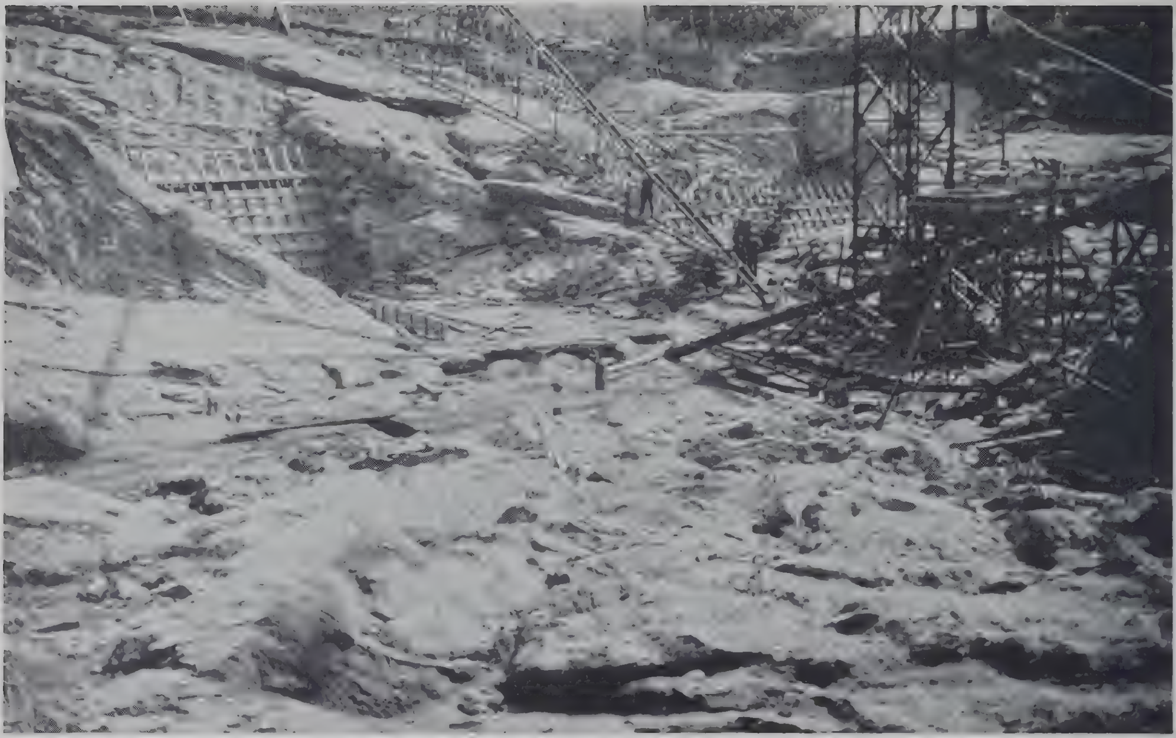
In Fort Lee about 95 per cent. of the total area required is now in the possession of the Port Authority. The greater portion of this property has been acquired by negotiation. Condemnation had to be instituted in a few cases, some in order to clear the title. In a number of other cases it has been unnecessary to carry the condemnation proceedings to conclusion since, after starting them, it has been possible to come to satisfactory terms with the owners.

CONSTRUCTION WORK

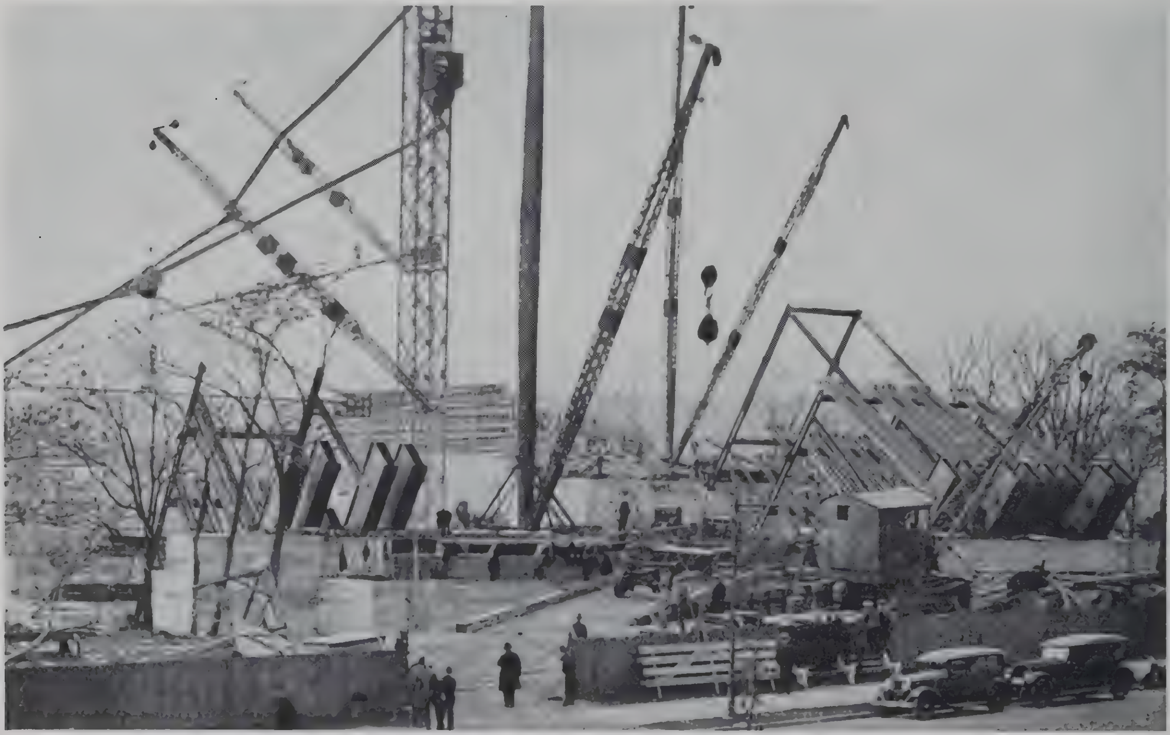
COMPLETION OF NEW JERSEY TOWER FOUNDATION

By the end of 1927 the two large cofferdams for the New Jersey tower foundation had been completed and the placing of concrete within them started. The work of building these cofferdams and the excavation to rock was described in the First Progress Report. Briefly, the silt overlying the rock was first dredged out to a uniform depth about 45 feet below the surface of the water and timber frames were sunk against which the steel sheet piling driven to rock was supported. In the deeper portions of the cofferdams the sheet piling formed double walls, separated by cross walls forming pockets into which, as the case required, either concrete, sand or silt was deposited. In the shallow portions of the cofferdams where the hydrostatic pressure was less, only a single wall of steel sheet piling was used. After the cofferdams were unwatered, excavation was started in the shallow portions and, as soon as a considerable area of the rock foundation was exposed, concreting was started and carried to such an elevation as to encase the lower three timbers of the frames. In this manner excavation and concreting proceeded step by step from the shallower to the deeper portions, the concrete in each step being brought up to approximately the same elevation.

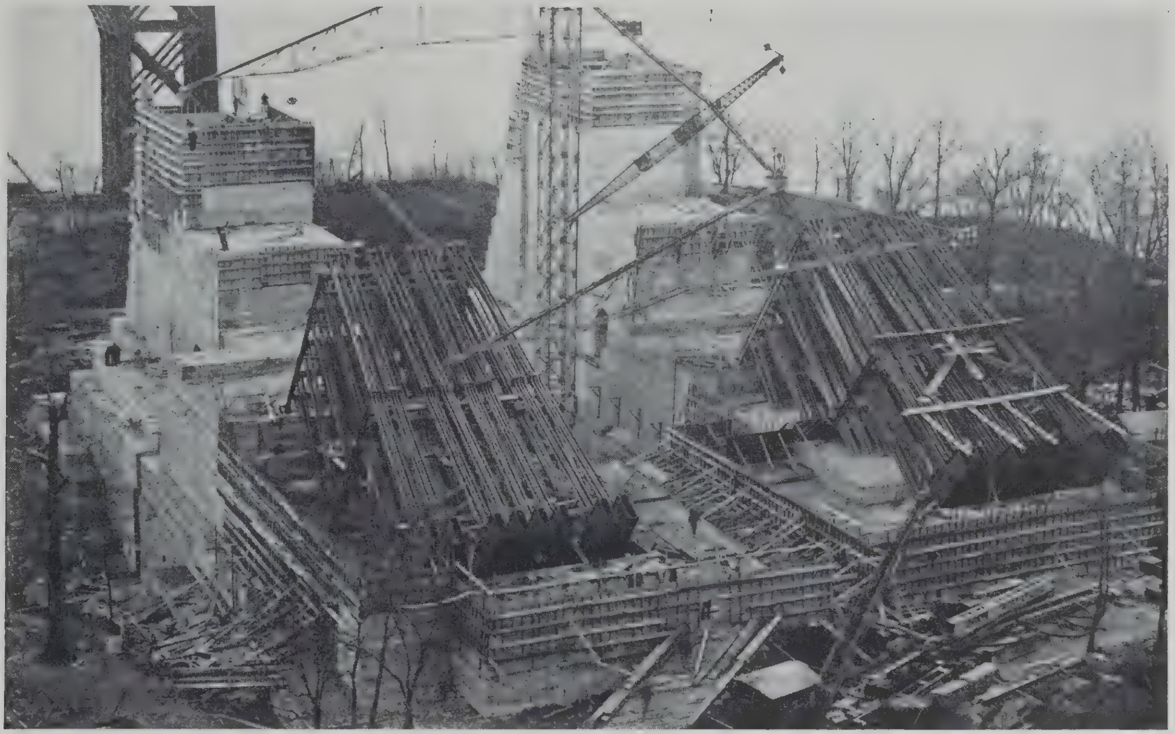
Upon the removal of the over-burden the rock was found to be throughout of solid sandstone of varied degrees of hardness and texture, and of very rugged surface. This was a most fortunate condition because the natural steps or benches formed a most excellent



ROCK FORMATION—NEW YORK ANCHORAGE FOUNDATION, SEPTEMBER 10, 1928—FORMS FOR CONCRETE BEARINGS OF ANCHORAGE GIRDERS IN BACKGROUND



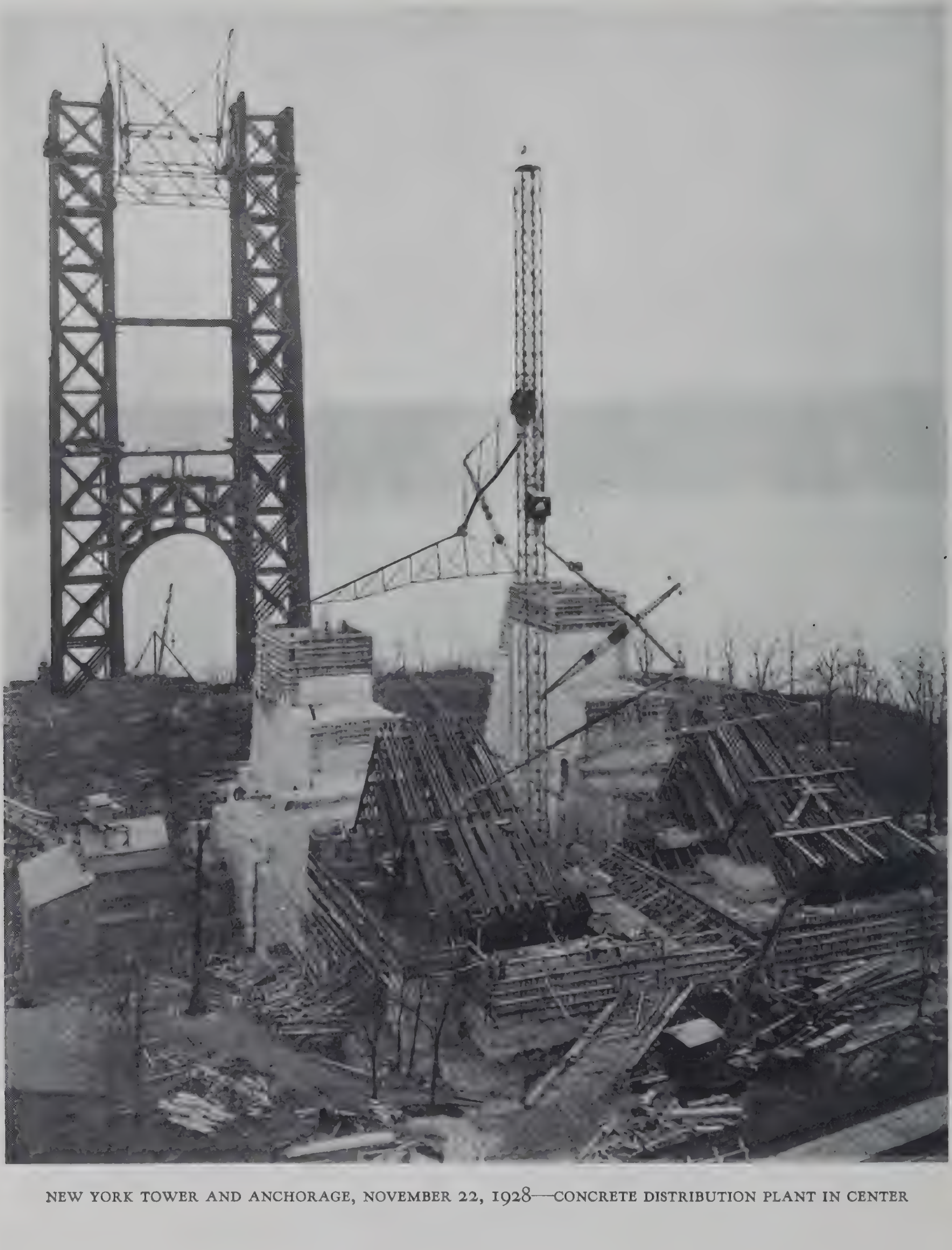
SETTING ANCHORAGE STEEL—NEW YORK ANCHORAGE, NOVEMBER 5, 1928 bond with the concrete so that little or no blasting of rock was required. The soft overburden of silt was largely removed hydraulically by flushing it to the centrifugal pumps which had been installed to unwater the cofferdams and to remove any seepage into them. The seepage in both cofferdams was so light that the pumps had ample capacity for removing the silt in this manner. Directly above the rock a stratum of shells, boulders and disintegrated material was found. These were removed by being loaded by hand into skips or buckets which were hoisted out of the cofferdams by derricks and deposited outside of the cofferdams.



NEW YORK ANCHORAGE, NOVEMBER 22, 1928—THE WIRE CABLES WILL BE ATTACHED TO THE STEEL ANCHORAGE WHICH WILL BE COMPLETELY BURIED IN THE ANCHORAGE MASONRY

After all excavation had been completed and the concrete over the entire area of the pier had been poured to such a level as to encase the lower three frames of timber the operation of concreting was carried on continuously, all further timbers being removed as the work proceeded. About nine feet below the water level the granite facing was begun and thereafter all concrete was poured course by course with the granite facing.

The contract for this work was executed on May 19, 1927, with Silas B. Mason of New York. Work was started promptly thereafter and was completed and accepted June 8, 1928. The contract involved 75,500 cubic yards of dredging, the placing 35,480 cubic yards of concrete, 1,400 cubic yards of granite and 300 tons of reinforcing steel. The total cost was $1,058,700.



NEW YORK TOWER AND ANCHORAGE, NOVEMBER 22, 1928—CONCRETE DISTRIBUTION PLANT IN CENTER

ROCK CUT FOR NEW JERSEY ANCHORAGE AND APPROACH

The New Jersey Approach consists essentially of an open cut through the Palisades and the New Jersey Anchorages of the cables extend 250 feet into that solid and hard traprock formation.

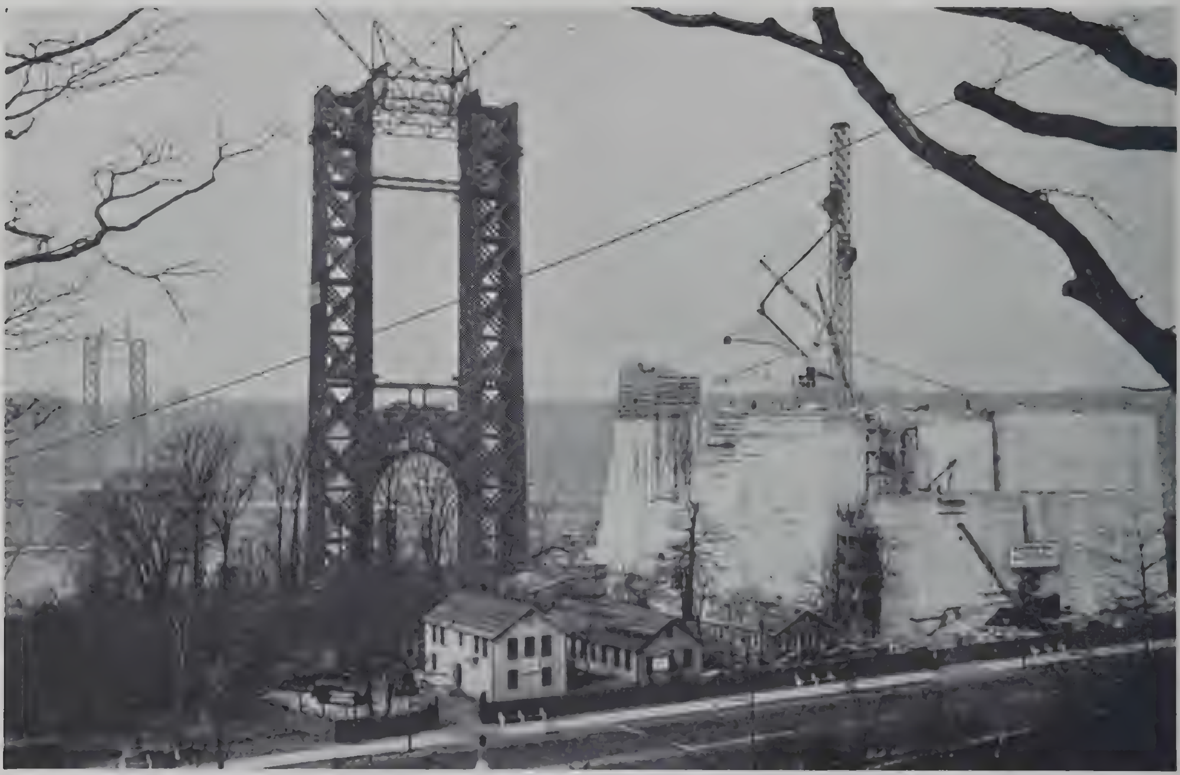
The roadway on the upper floor of the bridge intersects the rock face of the Palisades about 50 feet below the top of the Palisades and the lower floor is about 35 feet below the upper one. Below the lower level and at the head of the inclined tunnels or shafts in which the anchorages for the cables will be built are the anchorage pits, 47 feet deep, in which the 61 strands of each of the four cables will be splayed out and fastened to the steel eyebars which connect the cables with the anchorage girders located at the bottom of the shafts. These eyebars, chains and the anchorage girders are to be embedded in concrete which will completely fill the anchorage tunnels or shafts after the anchorages are erected. West of the anchorage pits the cut is to be excavated for the present only to the depth of the upper roadway. When the lower roadway on the bridge is constructed, the additional excavation for its extension under the approach roadway can be made without interruption to traffic either by open cut methods or by tunneling.

Throughout its length of 750 feet from the face of the Palisades to Hudson Terrace this rock cut will be 146 feet wide at the roadway level and, when complete, will involve the removal of approximately 220,000 cubic yards of rock.

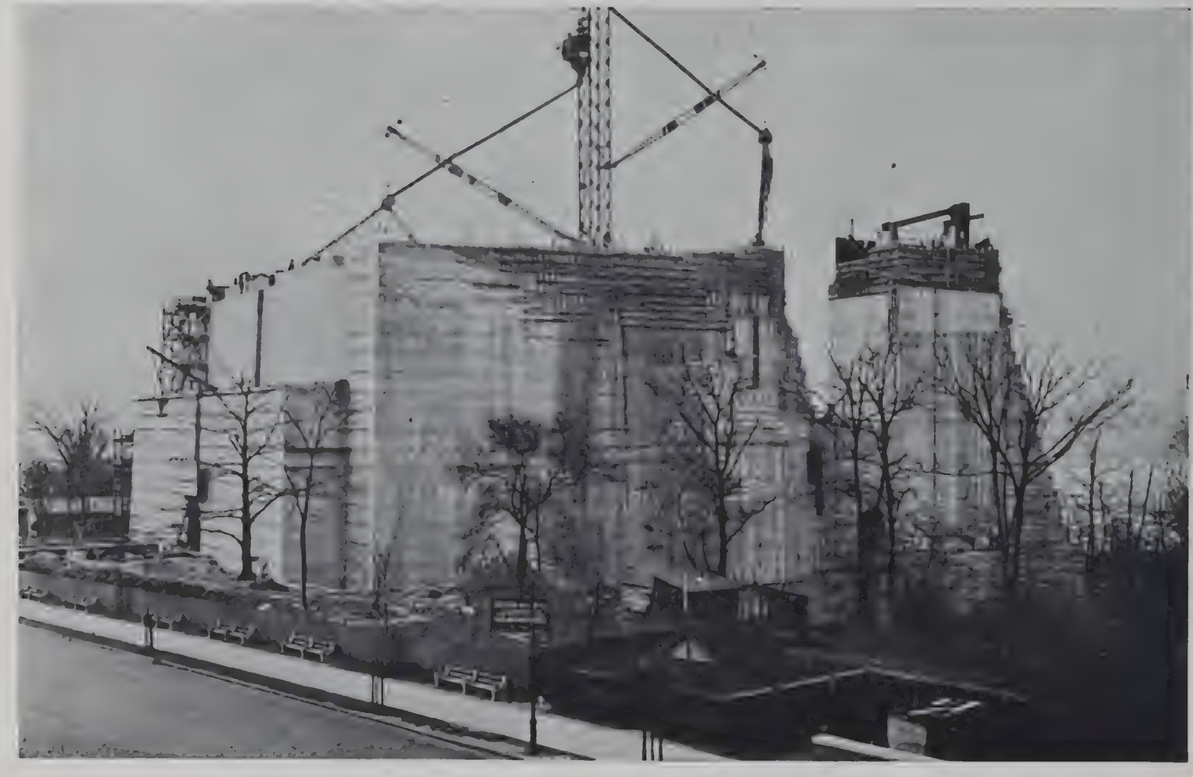
A contract for this rock excavation between the face of the Palisades and Hudson Terrace was executed on June 18, 1927, with Foley Brothers, Inc.

The contract also provides for the disposal of the excavated rock. This rock is the well-known Palisades traprock, the hardest rock in this district. When crushed it makes excellent material for concrete and road purposes. The contractor elected to install a complete crusher plant and to sell the crushed rock at the plant. About 95 per cent. of the rock excavated has been crushed and only a comparatively small portion which could not economically be delivered to the crusher plant has been otherwise disposed of in the vicinity.

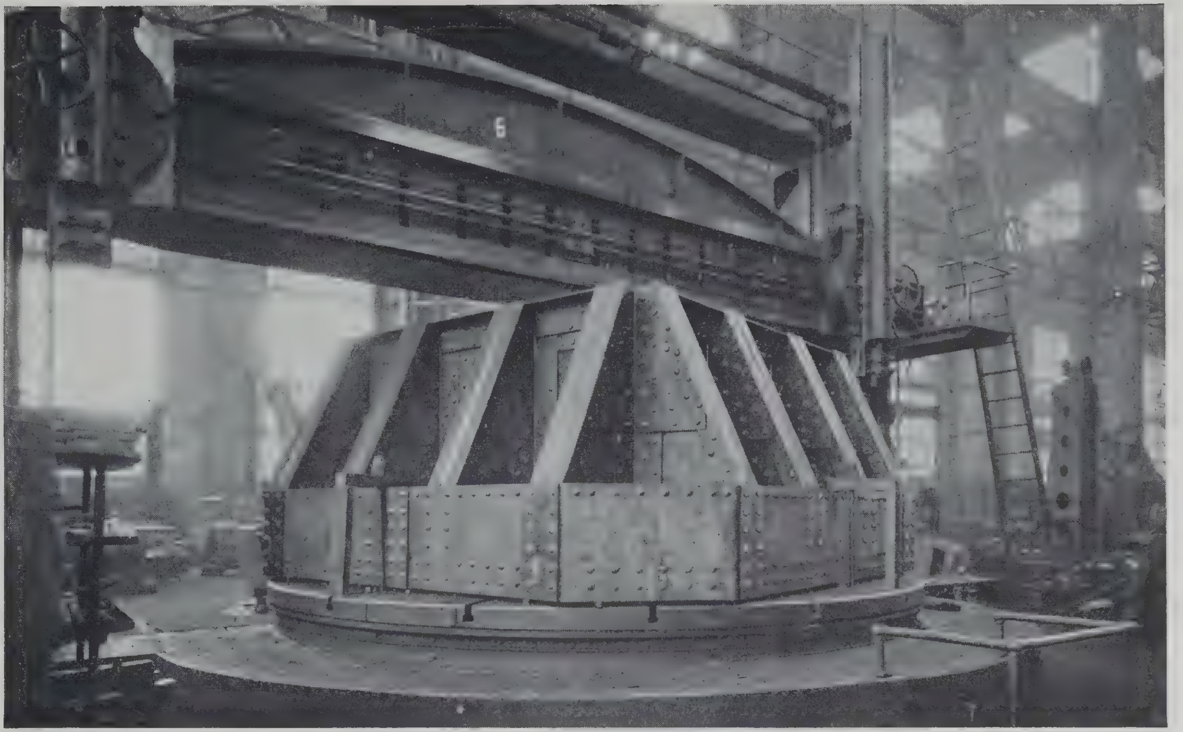
On account of the extreme hardness of the rock it was necessary to resort to special methods of blasting. This included the use of eight-inch well drills instead of the smaller tripod drills ordinarily used. In all, four such drilling machines were used. The large hole with the entire charge of dynamite concentrated at the bottom of the hole proved very effective. After blasting, the large pieces of rock were broken up, where necessary, by means of cast steel "skull crackers." In some cases larger stones had to be further drilled and blasted. The loose rock was then loaded on to trucks with gasoline and electric power shovels, or by derricks mounted on the edge of the cut and from there hauled to the crusher plant which was installed on top of the Palisades on Port Authority property adjacent to the cut. After being crushed and graded the rock was removed either direct to the point of demand or to large storage piles in the vicinity. On account of the magnitude of the operation the contractor has installed complete compressor plant, blacksmith shop, and drill sharpening plant—in short, a very complete plant necessary to do this work expeditiously.



GENERAL VIEW OF TOWERS AND NEW YORK ANCHORAGE, FEBRUARY 13, 1929



NEW YORK ANCHORAGE, FEBRUARY 13, 1929—CONCRETE BLOCK TO BE FACED LATER WITH GRANITE

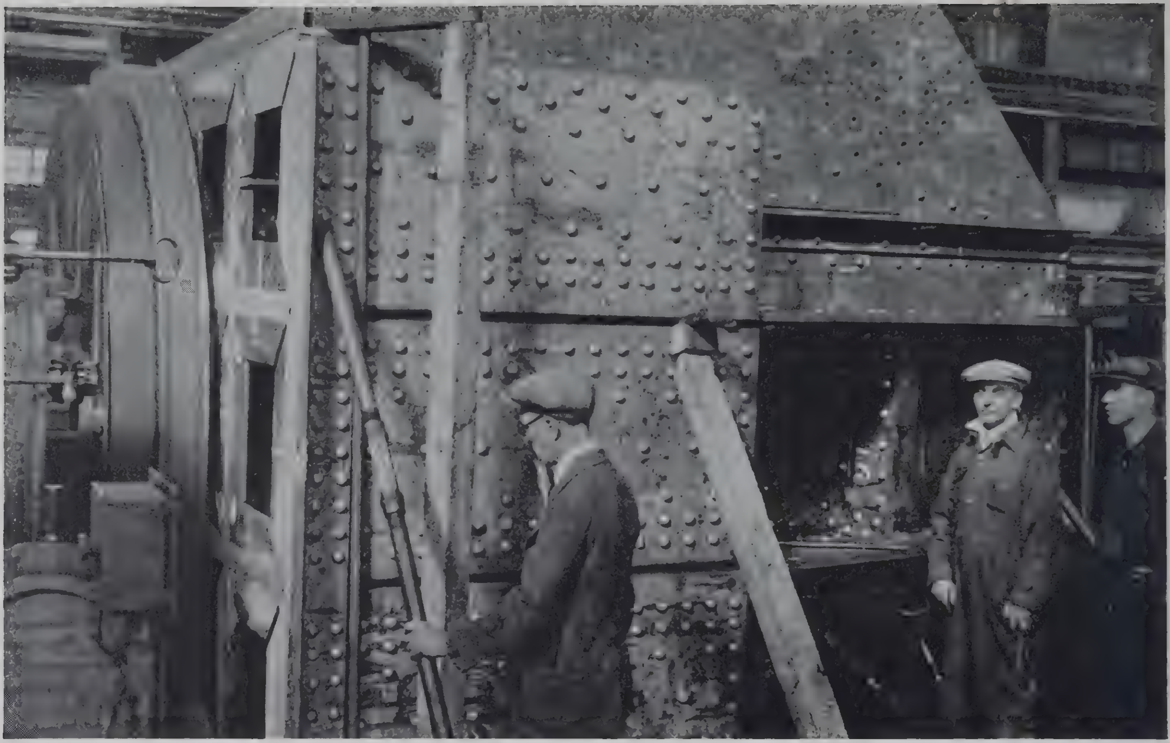


TOWER COLUMN BASE BEING PLANED IN SHOP, MARCH 1, 1928—A SINGLE BASE IS ABOUT FOURTEEN FEET SQUARE, SIX FEET HIGH AND WEIGHS ABOUT SIXTY TONS

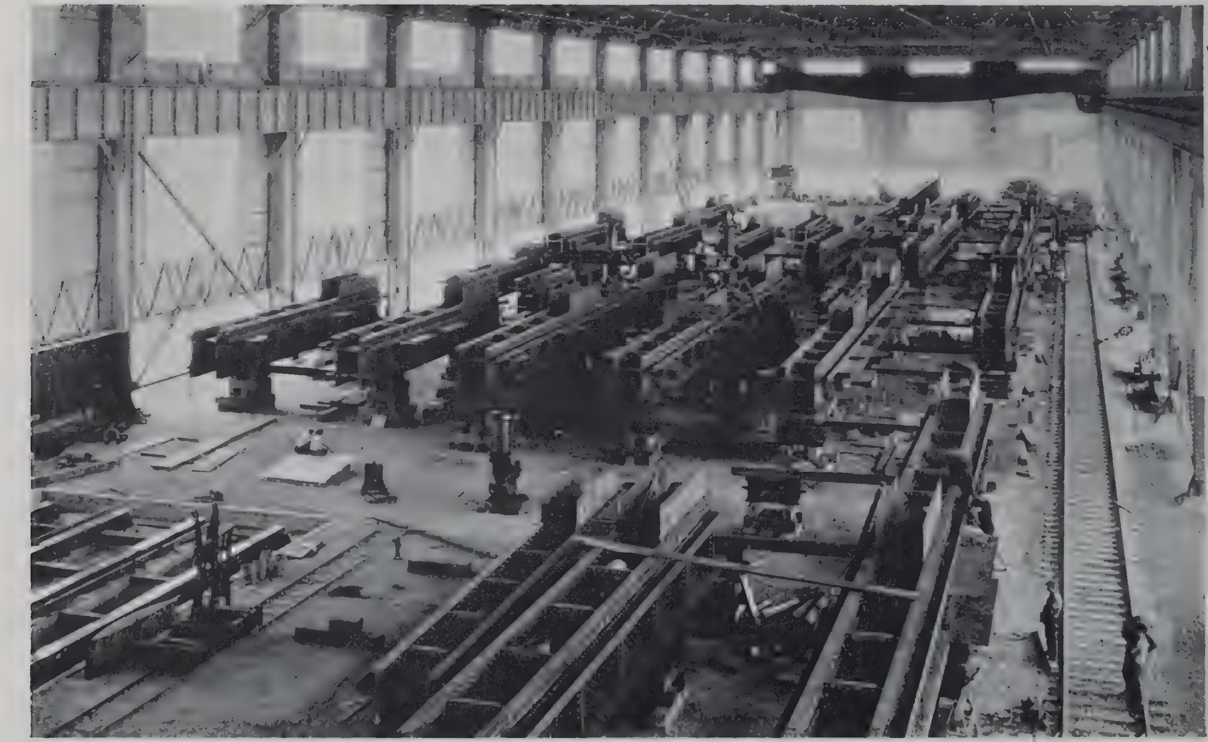
The work was started by first stripping off the overburden of dirt over the entire area to be excavated. Power shovels then started to excavate a narrow cut in the rock from Hudson Terrace east. This cut also served to provide access to the crusher plant by the trucks loaded in the cut. Work was then concentrated in the area east of the tunnel portals and carried on continuously 24 hours a day.

While this work proceeded the contractor sunk a vertical shaft, 7 feet by 9 feet in cross section and 250 feet deep, at a location just north of the extreme northerly edge of the cut and west of the extreme westerly end of the anchorage tunnels. From the bottom of this shaft a horizontal tunnel or drift was run to the south, somewhat beyond the southerly anchorage tunnel, and from this drift the excavation of the tunnels was carried on from the bottom up. This method offered two principle advantages. First, it enabled the contractor to work simultaneously and without interference in the cut, anchorage pits and tunnels, and secondly, it permitted the loading of all material blasted from the tunnels by gravity into the muck cars which traveled, in turn, by gravity to the shaft where they were hoisted to a trestle on the top of the Palisades and on that hauled to the crusher plant.

All work in the tunnels, anchorage pits and in the approach cut is now complete except for the general cleaning up and removal of the plant. The contract requires all work to be complete by January 1, 1930.



MILLING BOTTOM SECTION OF TOWER COLUMN, APRIL 6, 1928—ROTARY MILLING MACHINE ON LEFT—
—THIS COLUMN SECTION RESTS DIRECTLY UPON THE COLUMN BASE

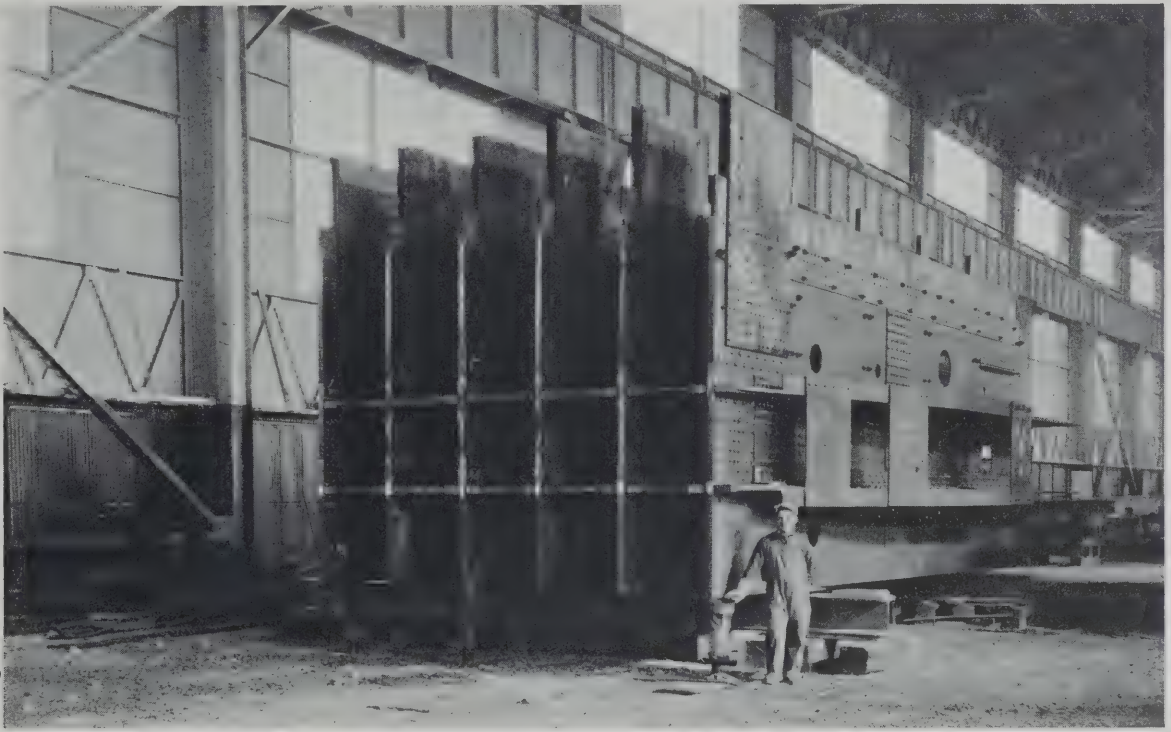


TOWER COLUMN SECTIONS IN FABRICATING SHOP, JULY 14, 1928

NEW YORK TOWER BASE AND NEW YORK ANCHORAGE

A contract for the initial stage of the New York tower base and the New York anchorage masonry was executed with Arthur McMullen Company on May 4th, 1928.

The New York tower foundation rests upon the rocky point at Jeffrey's Hook Light in Fort Washington Park and consists of two piers or bases, one under each leg of the tower, 153 feet center to center. Each base as now constructed measures 68 feet by 76.5 feet but will be increased to 76 by 84.5 feet when the granite facing is added which was omitted initially to expedite the building of the bases.

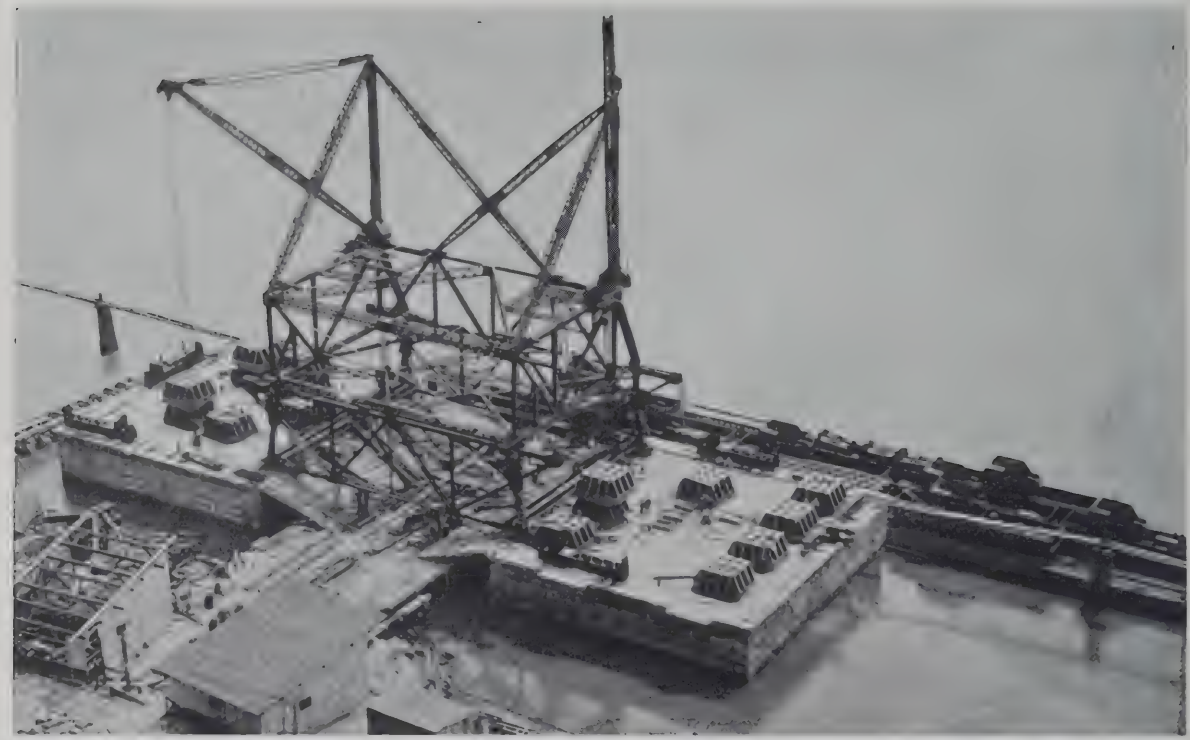


TOP SECTION OF TOWER COLUMN, FEBRUARY 19, 1929—THIS SECTION WEIGHS ABOUT 150 TONS. THE END VIEW CONTAINS ABOUT 3100 SQUARE INCHES

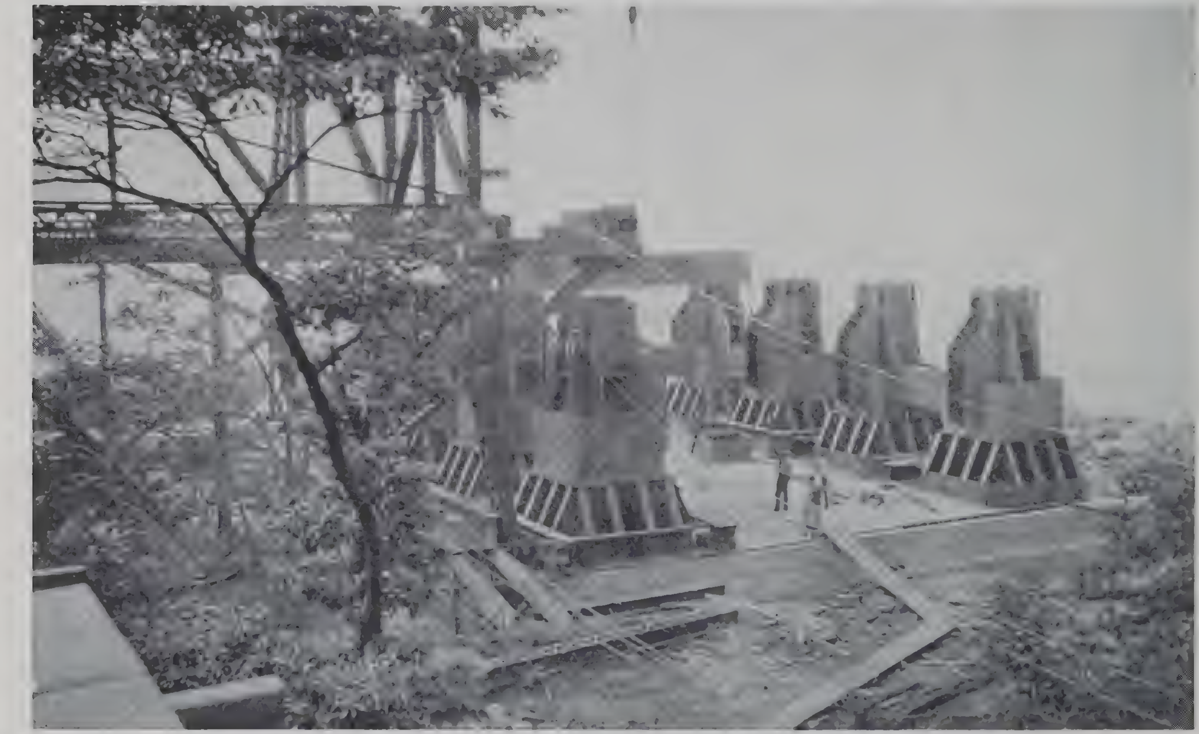
The rocky point upon which the piers are built is of such configuration that each base extends, in part, beyond the shore line. Shallow simple cofferdams were sufficient to exclude the water. The rock encountered is the typical Manhattan schist, very markedly stratified. The excavation revealed that disintegration of the rock had followed the seams to such depth that 85 per cent. more rock had to be excavated than was expected.

So expeditiously was this work carried out that it was possible to start erection of the steel tower by July 1, 1928.

While the contractor was building the tower bases near the shore he was also constructing his plant, making the excavation and doing the preparatory work for the construction of the anchorage block in Fort Washington Park just west of Riverside Drive.



ERECTION TRAVELER IN FIRST POSITION PLACING TOWER COLUMN BASES, JUNE 26, 1928—ELECTRIC HOISTING ENGINES IN SHEDS AT LEFT OF PICTURE



BASES AND BOTTOM SECTIONS OF TOWER COLUMNS IN PLACE, AUGUST 11, 1928

The anchorage will eventually represent a gigantic masonry block about 200 feet wide and 290 feet long at its base and 130 feet high and will rest on solid bedrock. It will be suitably treated architecturally with granite facing and will form a continuous structure with the massive viaduct over Riverside Drive.

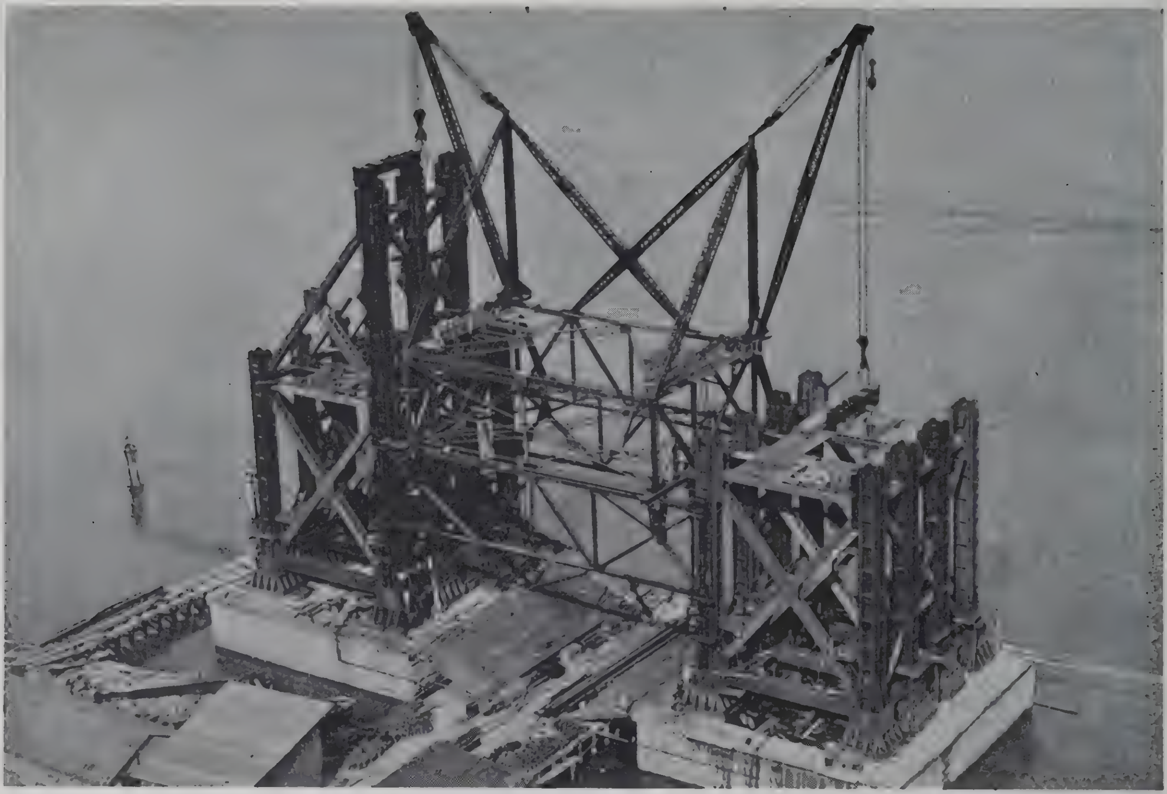
The anchorage will also be built in two stages. In the first stage, built under the present contract, all granite facing and some concrete backing is omitted, as well as some of the upper portions of the masonry and only such portions of the concrete are constructed as are necessary to permit the erection of the cables and their anchorages embedded in the concrete.

The contractor's plant for performing this anchorage work includes an extensive dock which he has built along the shore just south of the New York tower. All of the sand, gravel and cement are received by water at this dock. Two belt conveyors run from the dock to the mixer plant, one at low speed for moving the cement direct to the charging floor of the mixer plant which is located 800 feet from the shore on the high ground just south of the anchorage. The other belt runs at high speed and conveys the sand and gravel direct from the barges or storage piles nearby, to a bin above the mixer. All aggregates are proportioned by weight. There are two, one yard concrete mixers which alternately are charged and discharged into a hopper which controls the flow of the mixed concrete to a high speed belt. This belt conveys the concrete to a second hopper at the base of the concreting tower, which is 265 feet high and is located approximately in the center of the anchorage. From this tower the concrete is distributed to the forms by means of movable counterweight chutes. The entire plant has produced an average of more than 1,000 cubic yards of concrete in each 16-hour day. From September, 1928, when the plant was put in operation, until December, 90,000 cubic yards of concrete were placed without operating on Sundays or holidays. This is at the rate of about 7,000 cubic yards per week.

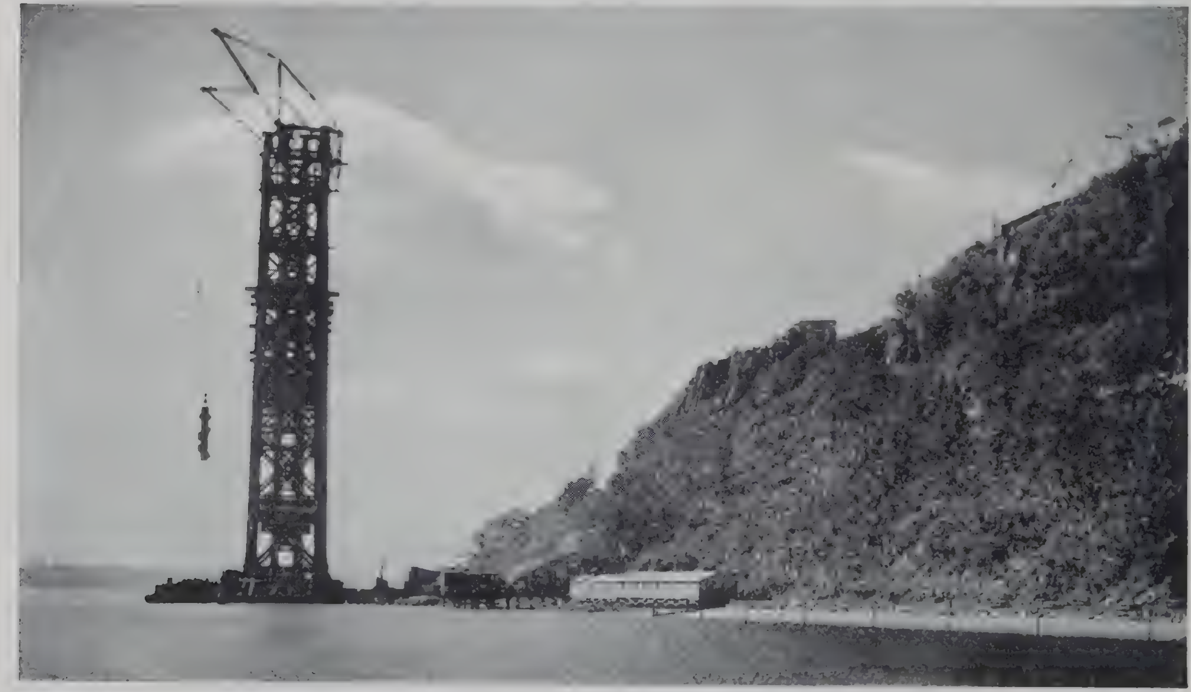
The 976 eyebars and the 20 heavy girders to which the eyebars are fastened, all forming the anchorage steelwork, were furnished and delivered to the site by the contractor for the cables and anchorage steelwork. The contractor for the anchorage masonry was required to set this steel in place. To do this the concrete was poured to a height well above the ground level, leaving pits, into which the steel framework was set. Steel frames supported the eyebars accurately in their proper positions. After all of the steelwork had been set and adjusted, concreting was begun and each pit filled in one continuous operation so as to avoid construction joints.

Great care has been taken in all of the concreting in this anchorage and particularly in the concrete which surrounds the anchorage steelwork so to proportion the aggregates and thoroughly mix them as to obtain an impervious mass. As a further protection against corrosion, all steelwork in the anchorage had been given three heavy coats of red lead paint.

The contract involved approximately 7,300 cubic yards of rock excavation and 9,700 cubic yards of concrete in the tower foundation; in the anchorage, 16,000 cubic yards of excavation, about 110,000 cubic yards of concrete and the setting of about 2,500 tons of anchorage steelwork. There will be in addition approximately 500 tons of reinforcing rods used. The total estimated cost of the contract is $1,150,000.



ERECTING NEW JERSEY TOWER, JULY 16, 1928—WHEN ALL EIGHT INSIDE COLUMNS AND BRACING HAVE BEEN ERECTED AS ON LEFT, THE TRAVELER IS RAISED TO ITS NEXT HIGHER POSITION



ERECTING NEW JERSEY TOWER, SEPTEMBER 26, 1928—RAISING COLUMN SECTION BY TRAVELER AT TOP OF WORK

FABRICATION AND ERECTION OF STEEL TOWERS

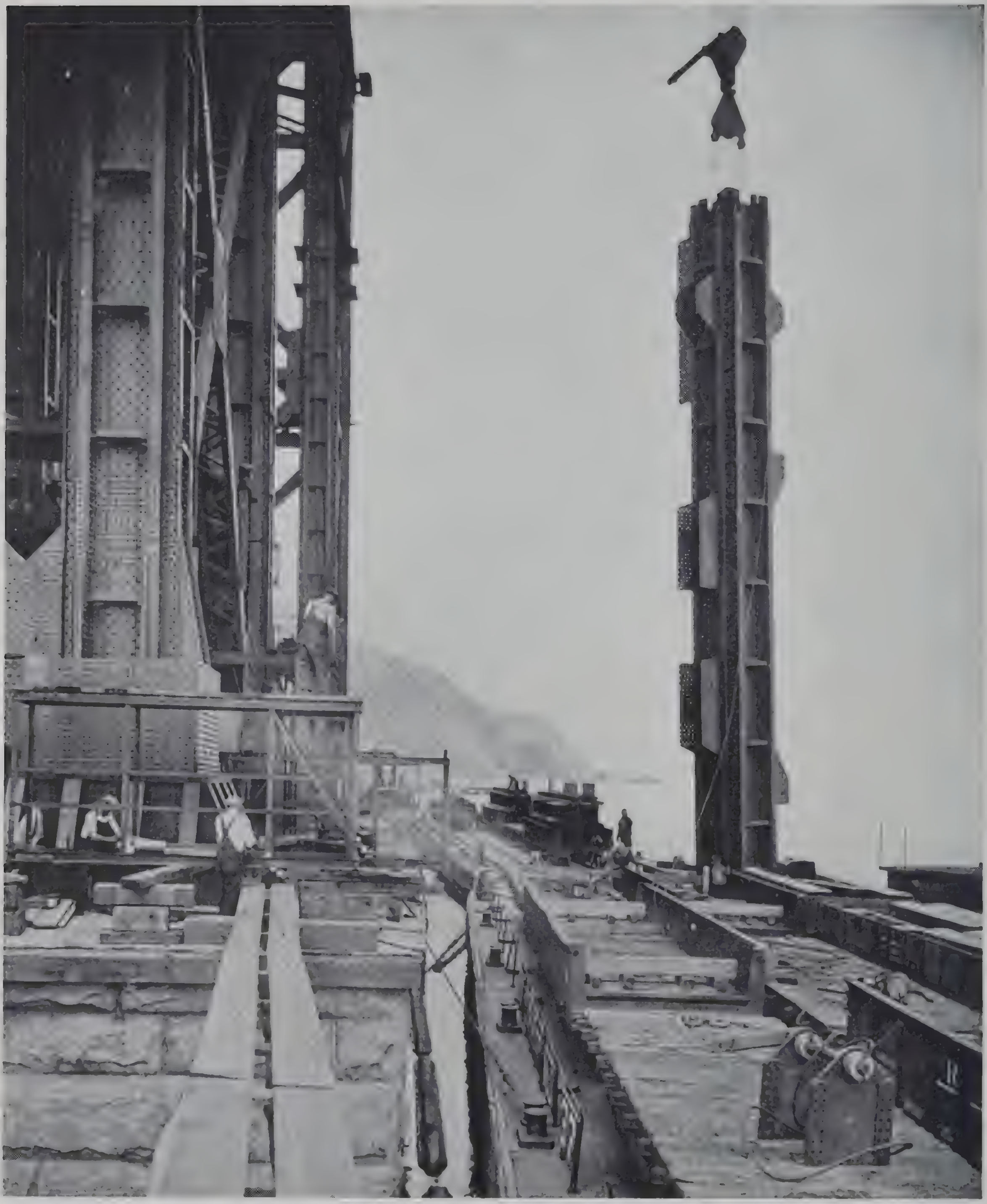
The towers, each of which carries at the top a load of 112,500 tons from the cables, consist of steel frames 556.5 feet high which are later to be encased in concrete and granite masonry. Each tower has 16 columns of silicon steel arranged in two groups of 8 columns each, one group being under each pair of cables. Each group of columns, or leg of the tower, is formed into a rigid structure by bracing between the columns and the two legs are connected by arched trusses below the level of the floor and at the top. The two towers will contain over 40,000 tons of steel.

Inside the steel skeleton of each tower two elevators are being provided to give access to all parts of the tower shaft for observation and maintenance. The great height of the towers makes their tops exceptional vantage points for observation and it is felt that means of access should be made available to the public.

The contract for the fabrication and erection of the towers was executed on November 4, 1927 with the McClintic-Marshall Company. Immediately thereafter the contractor started the preparation of typical detail drawings from which the shop drawings were made subsequently. The first orders for materials from the mills were placed before the end of the year and fabrication of this material began in January, 1928. In order that the fabrication of the towers might progress with sufficient rapidity to permit the erection to start at an early date and proceed with the necessary dispatch, the contractor sublet to the Bethlehem Steel Company the fabrication of the lower half of the New Jersey tower and to the American Bridge Company that of the lower half of the New York tower. The details of the lower parts of the two towers differ somewhat due to the fact that the roadway rises slightly from east to west. The McClintic-Marshall Company retained the fabrication of the upper parts of both towers which are alike, for its own shops, as well as the entire erection.

All of the material required for the towers has been rolled and all fabricating for and the erection of the first ten of the twelve panels in each tower are complete. It is essential that the tops of the columns in each leg of each tower shall be at the same elevation so that the saddles which support the cables shall have an even and uniform bearing upon them. To accomplish this it was considered necessary to stop erection on both towers after ten panels had been erected in order that accurate measurements might be taken and adjustments made in the length of the individual columns between the tenth panel and the top of the tower. So accurate was the work, however, that the maximum difference in length between the highest and lowest column in any of the four legs of the two towers was only three-sixteenths of an inch, and, in verticality, the variations were negligible. When it is considered that these results were obtained after the erection of over 15,000 tons of steel in each tower to a height of approximately 500 feet, the precision of the work is apparent. Correction, however, is being made even of the small difference in height of columns as found.

Prior to the completion of the erection of the first ten panels of both towers the fabricating shop proceeded so far as it was able with the fabrication of the remaining portions



RAISING TOWER COLUMN SECTION FROM CARFLOAT, JULY 26, 1928—MATERIAL IS STORED IN RAILROAD YARD WHERE, WHEN NEEDED FOR ERECTION, IT IS LOADED ON CARS AND TAKEN TO SITE BY CARFLOATS so that at the time of obtaining the results of the measurements the fabrication of this part of the work was well advanced. It is expected that the remaining fabrication will have progressed so as to permit the resumption of erection as early in the spring as weather conditions will permit and completion of the towers before summer.

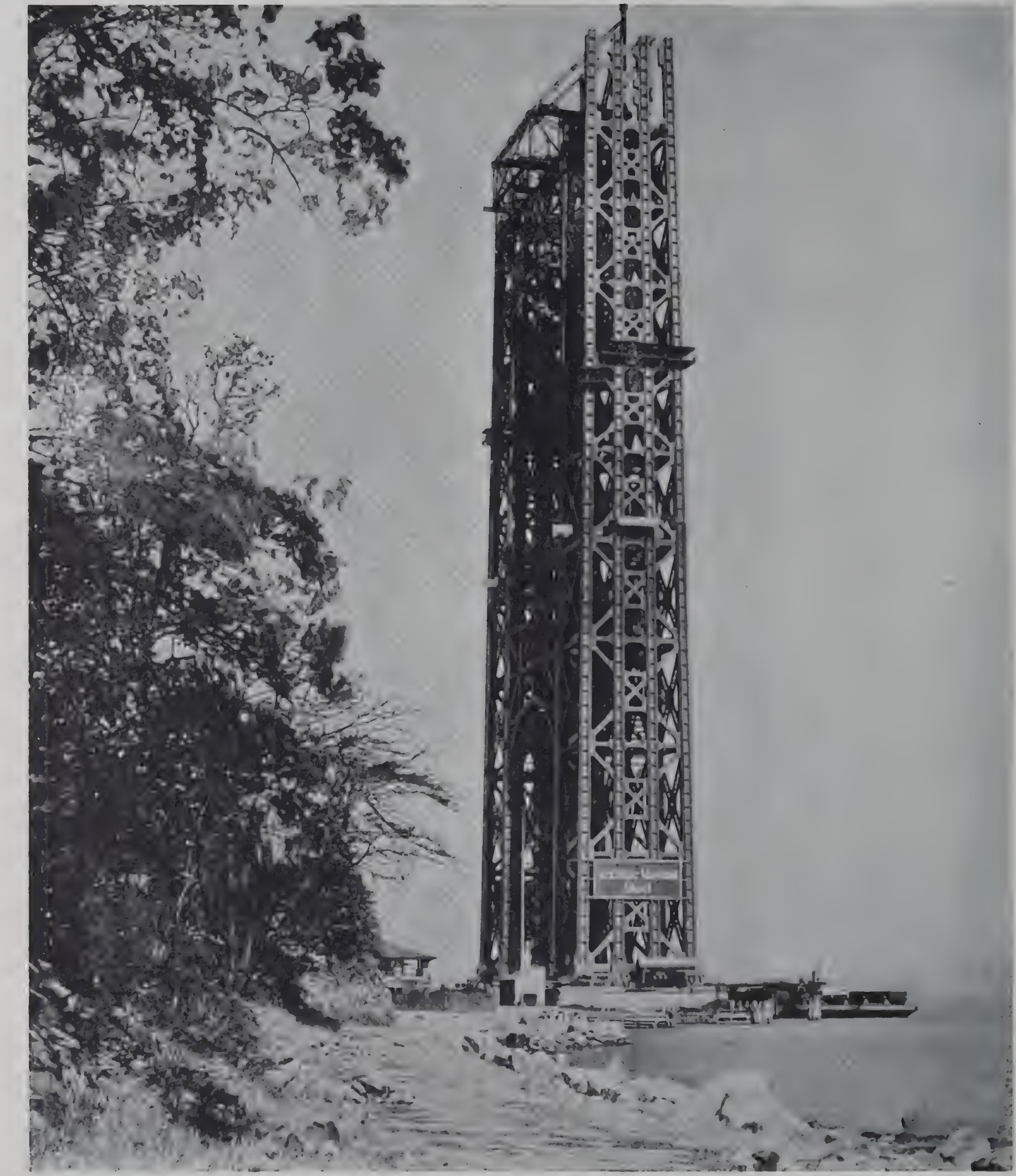
For the erection of each tower the contractor first erected on the two masonry piers and between the legs of each tower a structural steel traveler at the top of which were mounted two heavy steel derricks. On the New Jersey side these derricks lifted the steel members directly off the carfloats upon which they were delivered from the railroad storage yards. On the New York side, however, it was necessary to place an additional derrick on the ground surface between the tower and the shore. This derrick unloaded the steel from the carfloats and placed it within reach of the derricks on the traveler. Both travelers are operated from powerful electric hoisting engines which are mounted on concrete footings on the ground. At the first setting of the traveler the derricks placed the shoes, the first panel of each tower leg and the inside columns of the second panel. Blocks and steel cables attached to the portion of the steelwork already erected then lifted the traveler to the top of the erected steel. In this new position the traveler then erected first the outside columns of the second panel and then the inside columns of the third panel as well as all bracing between the columns. In this way the traveler continued to move from the bottom of the tower to the top, erecting panel by panel.

The contractor's plant includes also the necessary electrical transformer houses, electrically operated air pumps, scaffolds, ladders and the like. Of particular interest are the rivet scaffolds. These scaffolds are structural frames or cages which are suspended from the tower steelwork by steel blocks and tackle. They are provided with railings on the outside and ends so as to minimize the danger of workmen falling and a roof protects the men from falling material. When all of the rivets within reach of any one setting of the scaffold have been driven the scaffold is raised to a new level and thus the scaffolds starting at the bottom have been able to follow quite closely the progress of the erection. Various methods have been tried out and used for heating rivets—but the use of fuel oil has proved the most satisfactory. Mention should also be made of the installation of fire extinguishing equipment so that in case of emergency a fire could be extinguished promptly and before it could damage the steelwork.

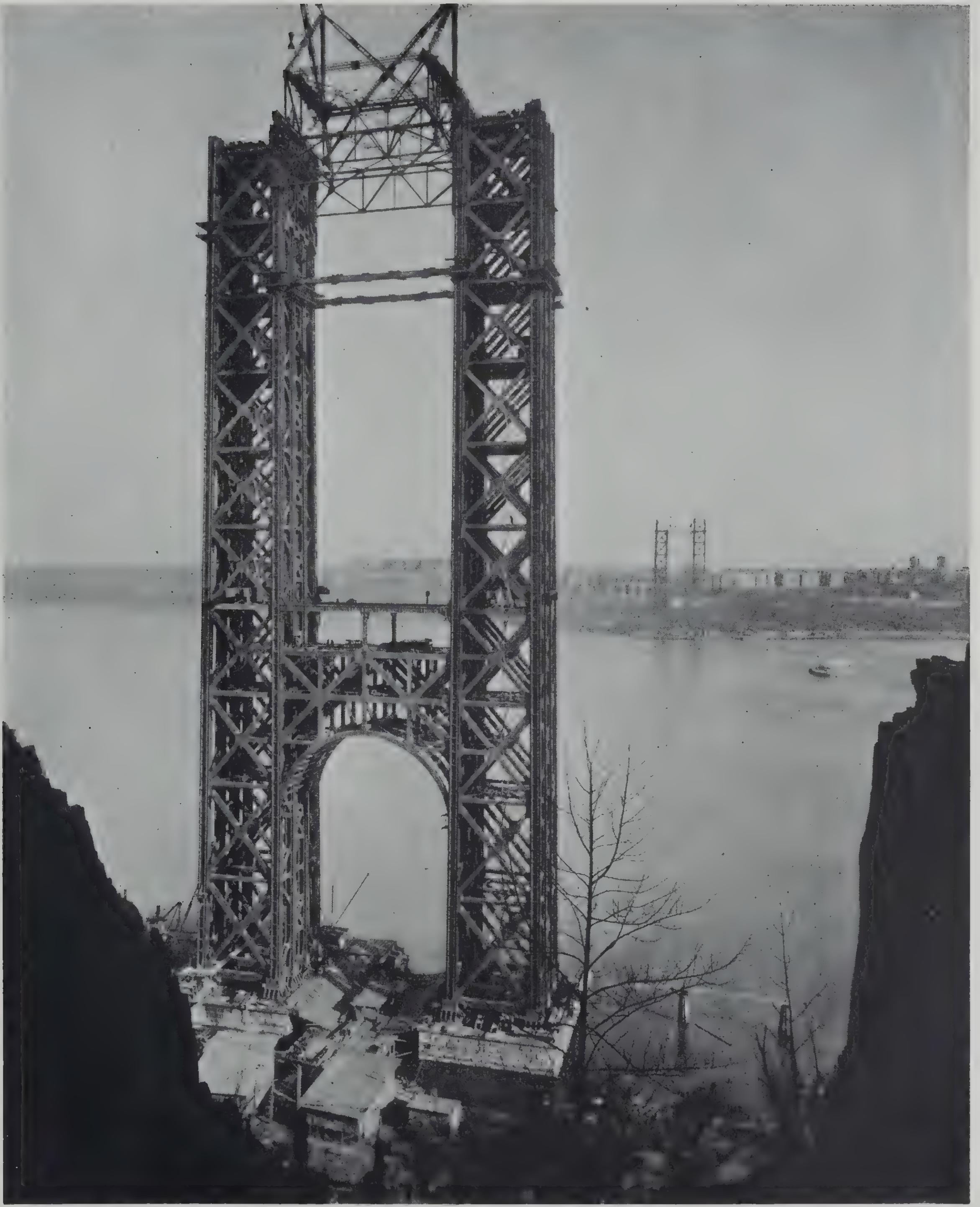
FABRICATION OF CABLE WIRE

The design of the bridge provides for four parallel wire cables, two on each side of the bridge, extending from anchorage to anchorage over cast steel saddles at the abutments and at the tops of the towers. In each cable there will be 26,474 double galvanized, high strength steel wires each 0.192 inches in diameter before galvanizing. During the process of spinning or stringing, the wires in each cable will be grouped into 61 strands, each strand having 434 wires. When compacted and wrapped each cable will have a diameter of approximately 36 inches.

The contract for the cables, suspenders and anchorage steelwork was executed on



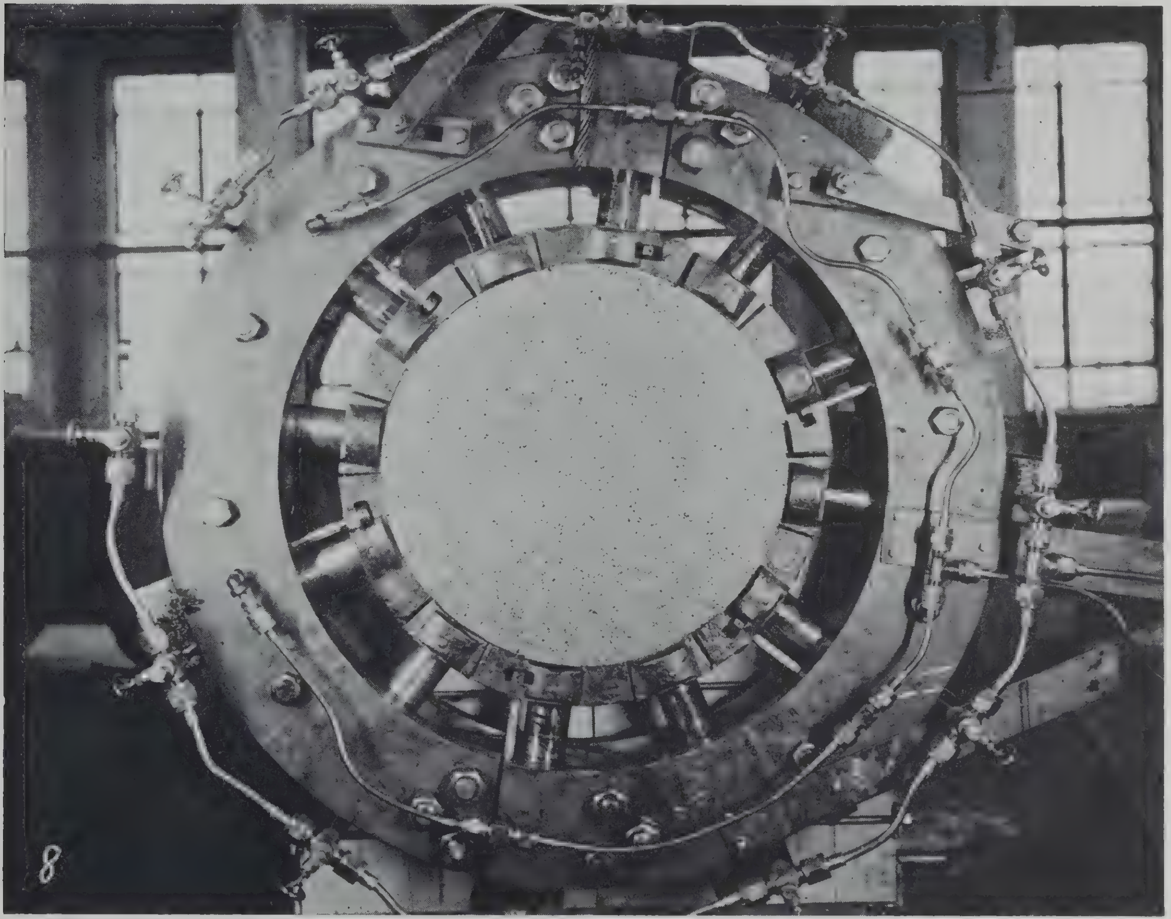
NEW JERSEY TOWER, OCTOBER 23, 1928—NOTE RIVETING SCAFFOLDS NEAR TOP



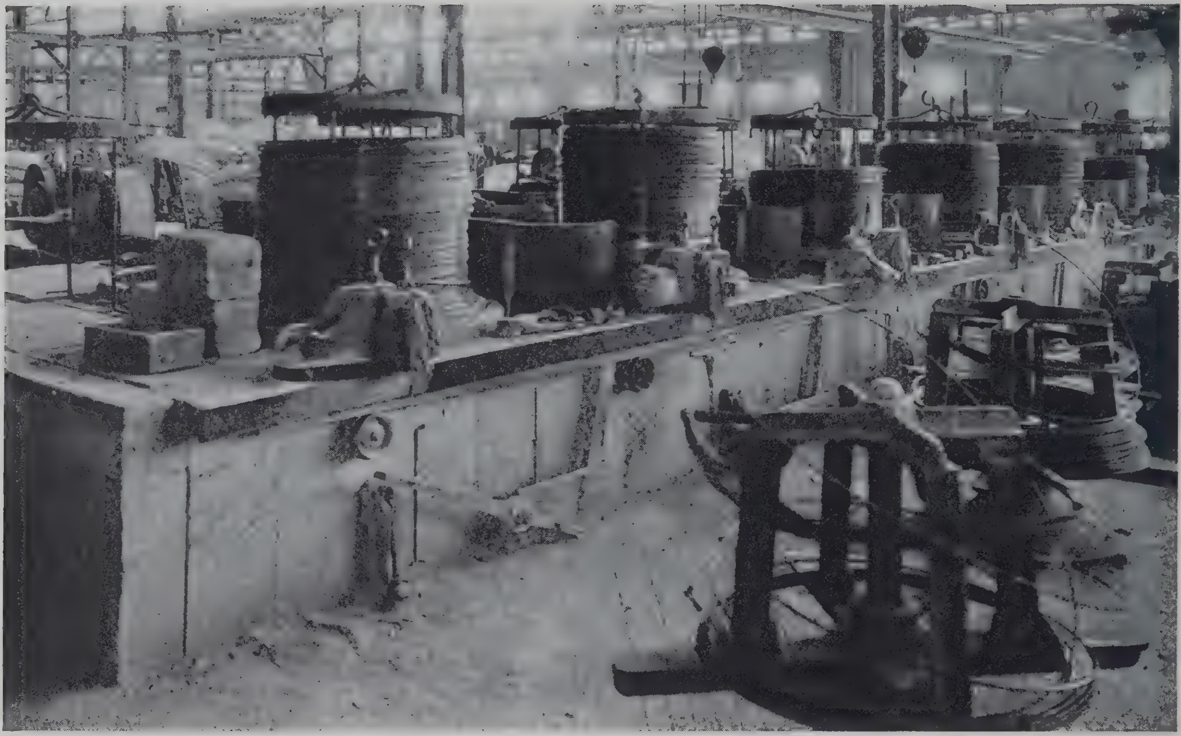
NEW JERSEY TOWER READY FOR ERECTING LAST TWO PANELS, NOVEMBER 10, 1928—NOTE TRAVELER AND RIVETING SCAFFOLDS. THE HORIZONTAL STRUT UNDER TRAVELER IS ONLY TEMPORARY

RIVETING A FIELD SPLICE OF A TOWER COLUMN, JULY 25, 1928—THERE ARE ABOUT 800,000 FIELD DRIVEN RIVETS IN THE TWO TOWERS

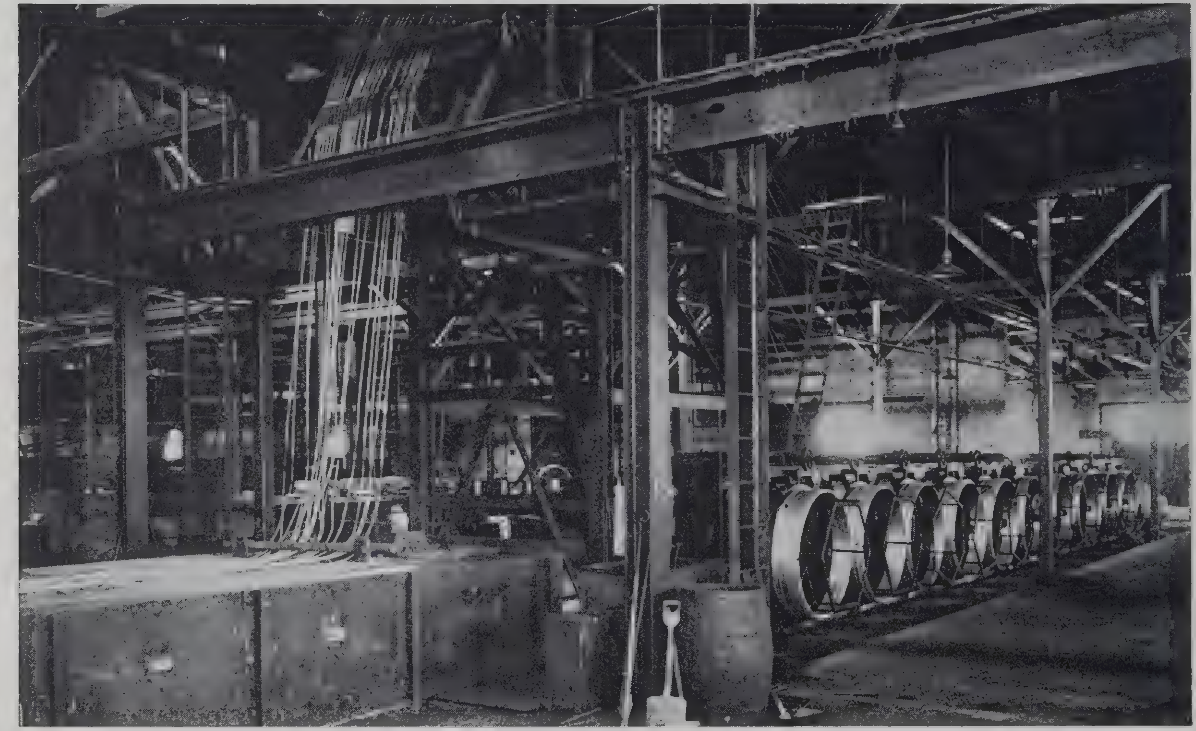
November 4, 1927, with the John A. Roebling's Sons Company of Trenton, N. J. The contract embraces approximately 29,000 tons of steel wire and 12,000 tons of structural steel and castings. It requires that the anchorage steelwork for the New York Anchorage should be delivered at the site of the New York Anchorage by April 1, 1928, so that it would be on hand when the Contractor for the New York Anchorage was ready to place it. All of this material was delivered at the Greenville yards in New Jersey considerably ahead of the time when it was needed in the anchorage and, on account of the restricted working space available in Fort Washington Park, was held in the railroad storage yard and delivered to the site from there as it was needed for placement in the anchorage. The contract also provides that the contractor for the cables and anchorage steelwork shall furnish and place the anchorage steelwork in the New Jersey Anchorage. All of the material required for this anchorage has been fabricated and delivered and the Contractor is now placing it in position.



MODEL CABLE SQUEEZED TO FINAL CROSS SECTION, OCTOBER 11, 1928—EACH OF THE TWELVE JACKS IN THE SQUEEZER IS CAPABLE OF EXERTING A PRESSURE OF THIRTY TONS



DRAWING CABLE WIRE, OCTOBER 11, 1928—THE WIRE IS COLD DRAWN BY JIGS THROUGH DIES MOUNTED ON THE SIDE OF THE BENCH. SOAP, IN BAGS IMMEDIATELY IN FRONT OF THE DIES, IS USED FOR LUBRICANT



GALVANIZING AND COILING CABLE WIRE, NOVEMBER 22, 1928—GALVANIZING BATH ON EXTREME LEFT. VERTICAL RUN IS TO ALLOW GALVANIZING TO COOL BEFORE COILING

On account of the large amount of wire required for the cables the contractor spent considerable time in the preparations in his plant for the manufacture of the wire. The first heat of metal to be used in the wire was drawn from the furnace on January 24, 1928, and the first wire was drawn about a month later. Since that time drawing has continued on a regular schedule so that there has now been manufactured and stored in the warehouses of the contractor about 40 per cent. of the total amount of wire required for the bridge. The contractor has also designed and fabricated much of the erection materials and equipment which he will require for his erection operations.

ACKNOWLEDGMENTS

Early in the year the Staff suffered an irreparable loss in the death of General Geo. W. Goethals, who had been acting as Consulting Engineer from the inception of the work and whose helpful advice on many of the important early problems was invaluable.

In its further elaboration of the plans and in the execution of the project the Staff has had the benefit of the advice and cooperation of many outside agencies and individuals which are herewith acknowledged.

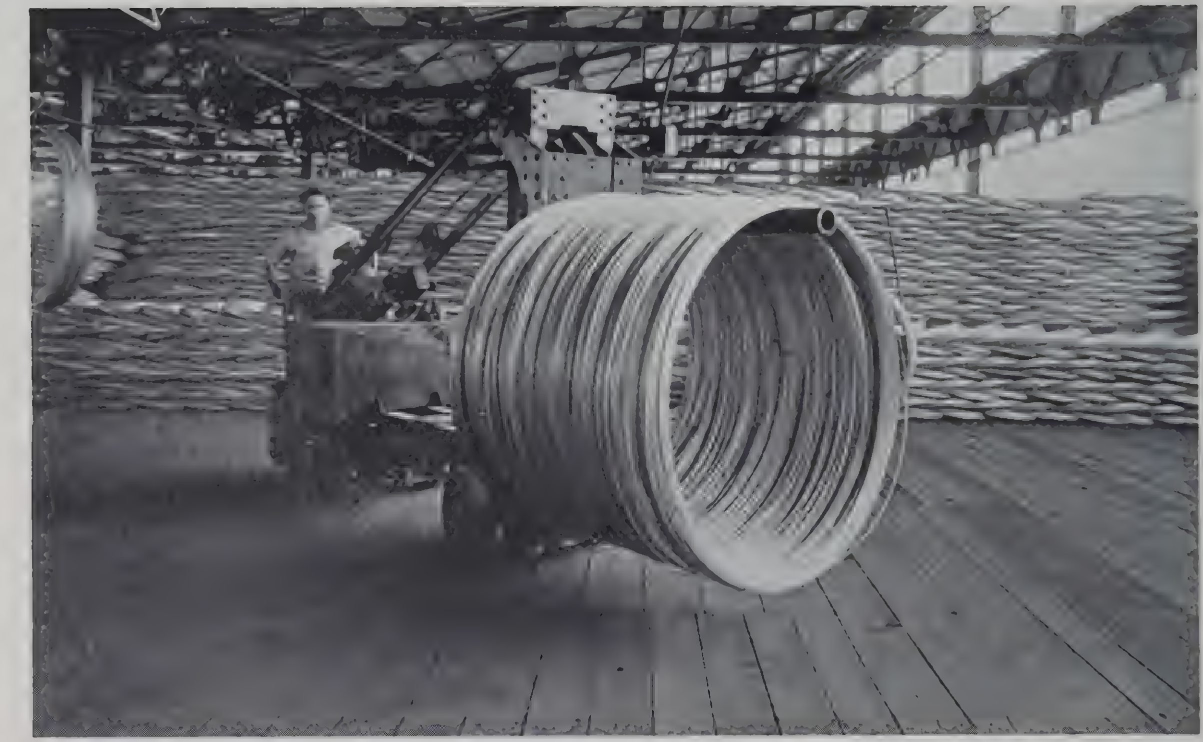
Further information regarding the volume and trend of vehicular traffic across the Hudson River was obtained through courtesy of the following companies: Central Railroad of New Jersey, Pennsylvania Railroad, Erie Railroad, Delaware, Lackawanna & Western Railroad, Electric Ferries Company, West Shore Railroad, Public Service Corporation of New Jersey and Dyckman & Englewood Ferry Company.

The U. S. District Engineer, First District, Colonel R. R. Ralston, granted various temporary permits aiding the construction of the bridge.

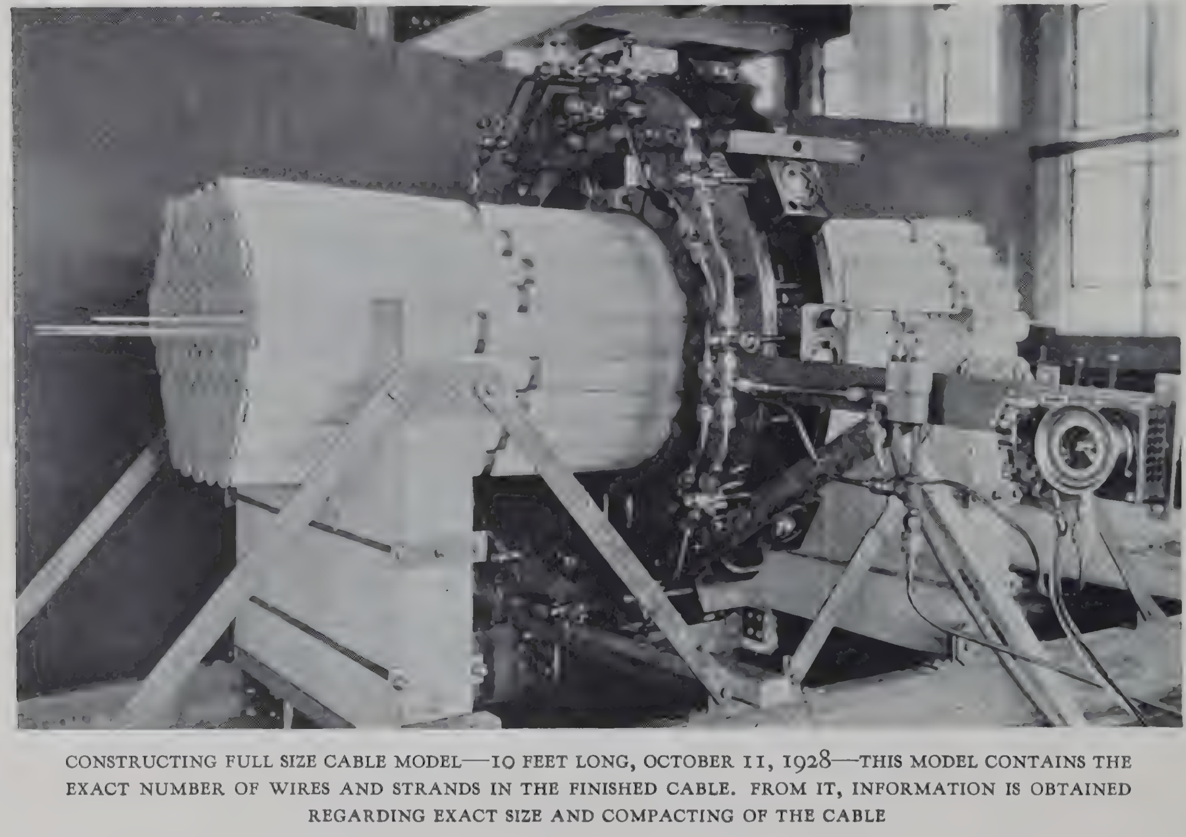
Progress of construction work throughout the year has been materially aided by the hearty cooperation on the part of the Chief Engineer, Major W. A. Welch, and members of the Palisades Interstate Park Commission whose property on the New Jersey side is utilized during construction, and by the very helpful attitude of the Hon. Walter R. Herrick, Commissioner of Parks of the City of New York, and his Staff who permitted the temporary occupation of parts of Fort Washington Park on the New York side.

The studies for the approaches and street connections have been conducted by the Staff jointly with the municipal, county and state representatives, who included, on the New York side, Mr. Arthur S. Tuttle, Consulting Engineer, Board of Estimate and Apportionment of the City of New York, and on the New Jersey side, Colonel Hugh A. Kelly representing the Governor of New Jersey, Major W. Griffith Sloan, State Highway Engineer of New Jersey, Mr. R. C. McClave, County Engineer of Bergen County and Mr. S. Wood McClave, Borough Engineer, Borough of Fort Lee.

Credit for the excellency and expediency with which the work has so far been performed is due very largely to the efforts of all the Contractors and their cooperation with the Staff. They are Silas Mason Company, Contractor for the New Jersey Foundation and Tower Bases; Foley Brothers, Inc., Contractor for the New Jersey Anchorage and Approach; Arthur McMullen Company, Contractor for New York Anchorage and Tower



CABLE WIRE IN STORAGE, OCTOBER 11, 1928—THERE ARE ABOUT 11,500 TONS OF WIRE NOW IN STORAGE. EACH COIL CONTAINS ABOUT 4000 FEET OF WIRE



CONSTRUCTING FULL SIZE CABLE MODEL—10 FEET LONG, OCTOBER 11, 1928—THIS MODEL CONTAINS THE EXACT NUMBER OF WIRES AND STRANDS IN THE FINISHED CABLE. FROM IT, INFORMATION IS OBTAINED REGARDING EXACT SIZE AND COMPACTING OF THE CABLE

Foundation; McClintic-Marshall Company, Contractor for Steel Towers and Floor System, and the John A. Roebling's Sons Company, Contractor for Steel Cables, Suspenders and Anchorage Steelwork.

The undersigned again takes this opportunity to express his appreciation to the Architect and the Consulting Engineers for their continued valuable aid and advice, to the members of the Legal and Real Estate Departments for their hearty cooperation and to the members of his Staff for their untiring diligence and devotion to this work.

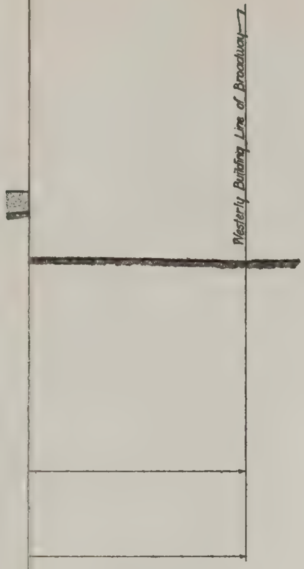
Respectfully submitted,

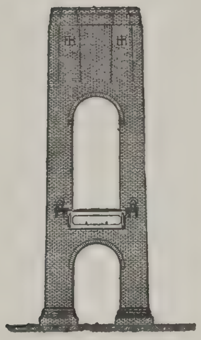
(Signed) O. H. AMMANN,
Chief Engineer of Bridges

HUDSON RIVER BRIDGE

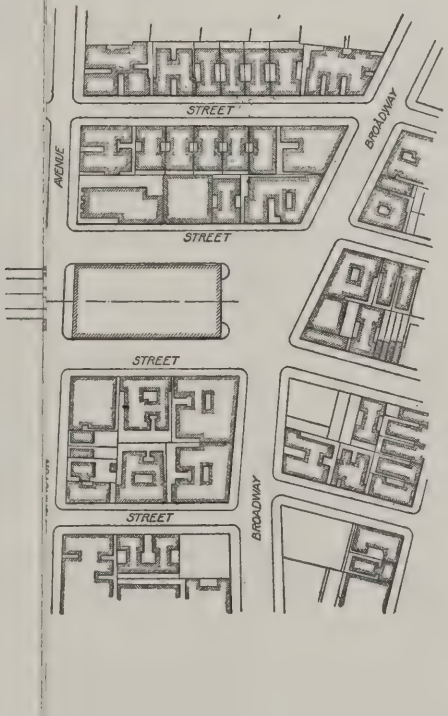
Financial Status—As at December 31, 1928

Estimated Cost of Initial Stage of Construction			$60,000,000.00
Financing Program			
Bond Issue authorized	$60,000,000.00		
Amount issued and sold as of December 1, 1926		$20,000,000.00	
Bonds to be presently issued and sold		30,000,000.00	
		$50,000,000.00	
Amounts to be made available in aid of construction			
From State of New York	$5,000,000.00		
From State of New Jersey	5,000,000.00	$10,000,000.00	$60,000,000.00
Resources from which expenditures have been made			
From Sale of Port Authority Bonds (Series "B")		$20,000,000.00	
From State advances		2,500,000.00	
Income from interest on bank balances, rents and other sources		1,231,904.21	$23,731,904.21
Expenditures to December 31, 1928			
Engineering		$ 787,295.07	
Investment in land		6,874,987.21	
For construction		10,140,809.66	
For administration and general expenses		241,375.55	
Interest paid on bonds during construction		1,729,148.63	
Discount and expenses during construction		89,666.08	
Unamortized Discount on Funded Debt		731,150.22	
Accounts receivable		26,564.08	
Unadjusted debits		8,151.97	
Amount paid for stock in Galric Company		500.00	
		$20,629,648.47	
Less amounts included above yet to be paid:			
Mortgages payable	$1,122,250.00		
Audited Vouchers payable	964,712.54		
Accrued Interest on debt	74,131.29	$ 2,161,093.83	$18,468,554.64
Cash on hand as of December 31, 1928			5,263,349.57
			$23,731,904.21
To Complete Construction			
Cash on hand as of December 31, 1928			$ 5,263,349.57
Due from States during 1929	$1,500,000.00		
Due from States during 1930	2,000,000.00		
Due from States during 1931	2,000,000.00		
Due from States during 1932	2,000,000.00	$ 7,500,000.00	
Bonds to be presently issued and sold		30,000,000.00	$37,500,000.00
Total resources to become available			$42,763,349.57
Estimated expenditures to complete			
Total amount of contracts already let	$26,062,351.07		
Amount expended on contracts, 12/31/28	10,140,809.66	$15,921,541.41	
Estimated amount of contracts to be let		12,170,000.00	
Contingencies		3,767,648.99	
Engineering		1,512,704.93	
Investment in land		2,125,012.79	
Administration and general expenses		458,624.45	
Interest to be paid during construction		3,413,089.50	$39,368,622.07
Estimated Surplus			$ 3,394,727.50





TRANSVERSE ELEVATION OF TOWER.

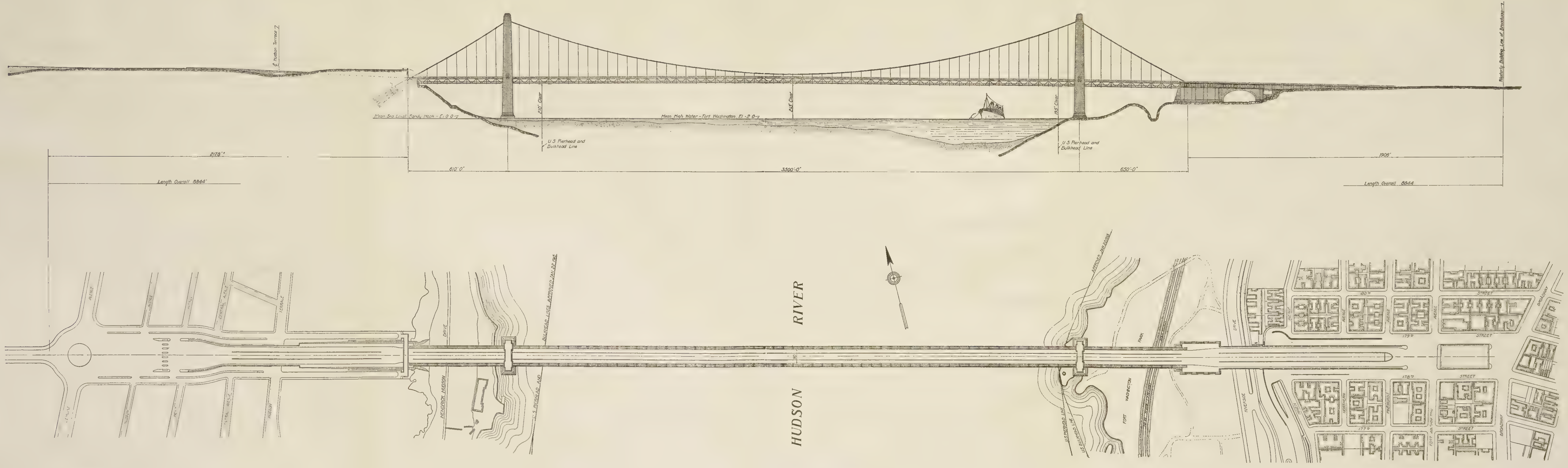


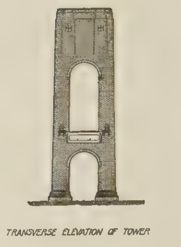
THE PORT OF NEW YORK AUTHORITY
HUDSON RIVER BRIDGE
FORT WASHINGTON – FORT LEE

GENERAL PLAN AND ELEVATION

SCALE IN FEET

FEB. 23, 1928. DRAWING NO. **HRB–11**





TRANSVERSE ELEVATION OF TOWER

THE PORT OF NEW YORK AUTHORITY
HUDSON RIVER BRIDGE
FORT WASHINGTON – FORT LEE

GENERAL PLAN AND ELEVATION

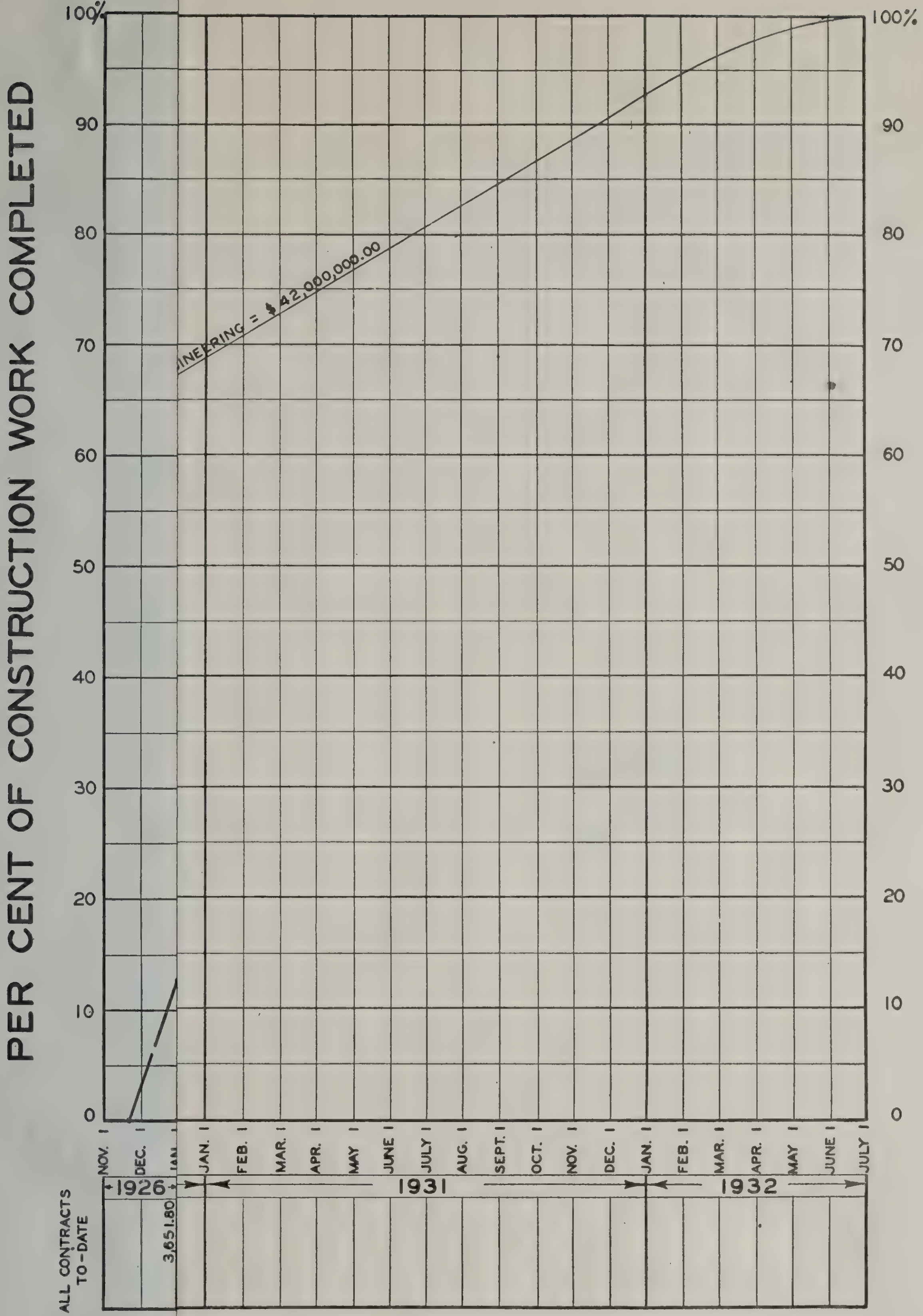
SCALE IN FEET

FEB. [illegible] DRAWING NO. HRB-11

	TEM 8 3 000 LBS. EX CING STEEL LACE IN HORAGE		ITEM 9 4,500,000 LBS. STRUCTURAL STEEL-WORK SET AND EMBEDDED IN ANCHORAGE		ESTIMATED TOTAL CONTRACT PRICE
	U P	*Amount*	*Unit Price*	*Amount*	
Arthur McMullen Co.	7	30,000	.01	45,000	986,600
E. O. Roberts Constr. Corp.	10	30,000	.015	67,500	1,046,090
Merritt, Chapman & Scott Corp.	6	30,000	.0116	52,200	1,081,850
Rosenthal Engr. Contr. Co., Inc.	3	33,750	.0125	56,250	1,115,285
P. T. Cox Contr. Co., Inc.	4	45,000	.013	58,500	1,135,405
Corson Constr. Corp.	6	37,500	.02	90,000	1,165,375
Remo Eng. Corp.	10	41,250	.015	67,500	1,175,985
The Arthur A. Johnson Corp.	7	41,250	.015	67,500	1,186,116
The Foundation Co.	4	41,250	.012	54,000	1,195,560
H. P. Converse	10	40,500	.02	90,000	1,202,686
Triest Contr. Corp.	11	30,000	.008	36,000	1,211,000
Rosoff Bros., Inc.	7	30,000	.016	72,000	1,228,575
Cornell Contr. Corp.	9	52,500	.01	45,000	1,288,000
Wilson & English Constr. Co.	10	37,500	.013	58,500	1,297,100
Anthony Cianciulli	6	37,500	.018	81,000	1,301,280
Mid-East Constr. Corp.	11	30,000	.015	67,500	1,310,000
Foley Bros., Inc.	10	45,000	.0175	78,750	1,320,500
W. H. Gahagan, Inc.	7	37,500	.015	67,500	1,354,100
Lyons Slattery Co., Inc.	9	37,500	.015	67,500	1,372,075
Clent Constr. Co., Inc.	11	48,750	.011	49,500	1,386,930
J. F. Murphy Contr. Co., Inc.	12	37,500	.02	90,000	1,396,235
Jos. T. Rice	6	37,500	.016	72,000	1,421,875
Peter F. Connolly Co.	20	45,000	.02	90,000	1,422,950
Bates & Rogers, Inc.	8	45,000	.015	67,500	1,424,250
Del Balso Constr. Corp.	8	36,000	.0155	69,750	1,465,855
Clemente Contr. Co., Inc.	8	37,500	.025	112,500	1,493,675
Frederick Snare Corp.	9	37,500	.019	85,500	1,510,350
D. C. Serber, Inc.	11	37,500	.013	58,500	1,514,675
The Geo. Colan Constr. Co.	9	45,000	.0175	78,750	1,556,425
Silas Mason Co., Inc.	10	30,000	.01	45,000	1,604,450
T. A. Gillespie Co.	10	37,500	.01	45,000	1,612,300
J. F. Cogan Co., Contractors	10	45,000	.0155	69,750	1,773,425

TABULATION OF BIDS FOR NEW YORK ANCHORAGE AND FOUNDATION TOWER

	Item 1 3,800 cu. yd. Excavation for Tower Foundation		Item 2 5,500 cu. yd. Concrete in Place in Tower Foundation		Item 3 7,500 bbls. Cement Mixed in Concrete in Tower Foundation		Item 4 230,000 lbs. Reinforcing Steel in Place in Tower Foundation		Item 5 13,000 cu. yd. Excavation for Anchorage		Item 6 103,000 cu. yd. Concrete in Place in Anchorage		Item 7 140,000 bbls. Cement Mixed in Concrete in Anchorage		Item 8 750,000 lbs. Reinforcing Steel in Place in Anchorage		Item 9 4,500,000 lbs. Structural Steel-Work Set and Embedded in Anchorage		Estimated Total Contract Price
	Unit Price	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	*Unit Price*	*Amount*	
Arthur McMullen Co.	7.00	26,600	7.00	38,500	2.20	16,500	.04	9,200	3.00	39,000	4.60	473,800	2.20	308,000	.04	30,000	.01	45,000	986,600
E. O. Roberts Constr. Corp.	10.00	38,000	8.00	44,000	2.40	18,000	.04	9,200	6.00	78,000	4.13	425,390	2.40	336,000	.04	30,000	.015	67,500	1,046,090
Merritt, Chapman & Scott Corp.	6.00	22,800	6.50	35,750	2.40	18,000	.04	9,200	3.65	47,450	5.15	530,450	2.40	336,000	.04	30,000	.0116	52,200	1,081,850
Rosenthal Engr. Contr. Co., Inc.	3.75	14,250	5.75	31,625	3.00	22,500	.045	10,350	3.25	42,250	4.77	491,310	2.95	413,000	.045	33,750	.0125	56,250	1,115,285
P. T. Cox Contr. Co., Inc.	4.00	15,200	6.00	33,000	2.55	19,125	.06	13,800	4.00	52,000	5.26	541,780	2.55	357,000	.06	45,000	.013	58,500	1,135,405
Corson Constr. Corp.	6.00	22,800	5.20	28,600	2.45	18,375	.05	11,500	6.00	78,000	5.20	535,600	2.45	343,000	.05	37,500	.02	90,000	1,165,375
Remo Eng. Corp.	10.00	38,000	9.32	51,260	2.65	19,875	.05	11,500	3.90	50,700	5.30	545,900	2.50	350,000	.055	41,250	.015	67,500	1,175,985
The Arthur A. Johnson Corp.	7.32	27,816	6.10	33,550	3.00	22,500	.06	13,800	3.75	48,750	5.45	561,350	2.64	369,600	.055	41,250	.015	67,500	1,186,116
The Foundation Co.	4.75	18,050	6.10	33,550	3.34	25,050	.06	13,800	4.60	59,800	4.82	496,460	3.24	453,600	.055	41,250	.012	54,000	1,195,560
H. P. Converse	10.72	40,736	11.55	63,525	2.51	18,825	.073	16,790	9.40	122,200	4.97	511,910	2.13	298,200	.054	40,500	.02	90,000	1,202,686
Triest Contr. Corp.	11.00	41,800	9.00	49,500	2.80	21,000	.04	9,200	5.00	65,000	5.50	566,500	2.80	392,000	.04	30,000	.008	36,000	1,211,000
Rosoff Bros., Inc.	7.00	26,600	7.00	38,500	2.25	16,875	.04	9,200	5.50	71,500	6.30	648,900	2.25	315,000	.04	30,000	.016	72,000	1,228,575
Cornell Contr. Corp.	9.00	34,200	10.00	55,000	3.00	22,500	.07	16,100	7.50	97,500	6.00	618,000	2.48	347,200	.07	52,500	.01	45,000	1,288,000
Wilson & English Constr. Co.	10.00	38,000	9.00	49,500	2.50	18,750	.045	10,350	5.00	65,000	6.50	669,500	2.50	350,000	.05	37,500	.013	58,500	1,297,100
Anthony Cianciulli	6.00	22,800	10.00	55,000	2.40	18,000	.05	11,500	7.00	91,000	6.16	634,480	2.50	350,000	.05	37,500	.018	81,000	1,301,280
Mid-East Constr. Corp.	11.00	41,800	9.00	49,500	3.50	26,250	.05	11,500	7.00	91,000	5.15	530,450	3.30	462,000	.04	30,000	.015	67,500	1,310,000
Foley Bros., Inc.	10.00	38,000	11.00	60,500	3.00	22,500	.06	13,800	10.00	130,000	5.65	581,950	2.50	350,000	.06	45,000	.0175	78,750	1,320,500
W. H. Gahagan, Inc.	7.50	28,500	10.00	55,000	3.00	22,500	.05	11,500	6.50	84,500	6.70	690,100	2.55	357,000	.05	37,500	.015	67,500	1,354,100
Lyons Slattery Co., Inc.	9.00	34,200	6.00	33,000	3.25	24,375	.05	11,500	7.00	91,000	6.00	618,000	3.25	455,000	.05	37,500	.015	67,500	1,372,075
Clent Constr. Co., Inc.	11.00	41,800	13.50	74,250	2.70	20,250	.065	14,950	5.65	73,450	6.66	685,980	2.70	378,000	.065	48,750	.011	49,500	1,386,930
J. F. Murphy Contr. Co., Inc.	12.00	45,600	10.00	55,000	3.25	24,375	.05	11,500	5.00	65,000	6.42	661,260	2.90	406,000	.05	37,500	.02	90,000	1,396,235
Jos. T. Rice	6.25	23,750	8.25	45,375	2.50	18,750	.05	11,500	3.00	39,000	8.00	824,000	2.50	350,000	.05	37,500	.016	72,000	1,421,875
Peter F. Connolly Co.	20.00	76,000	10.00	55,000	3.00	22,500	.07	16,100	8.00	104,000	6.45	664,350	2.50	350,000	.06	45,000	.02	90,000	1,422,950
Bates & Rogers, Inc.	8.00	30,400	9.30	51,150	3.30	24,750	.05	11,500	9.00	117,000	6.65	684,950	2.80	392,000	.06	45,000	.015	67,500	1,424,250
Del Balso Constr. Corp.	8.30	31,540	9.75	53,625	2.88	21,600	.048	11,040	7.50	97,500	7.20	741,600	2.88	403,200	.048	36,000	.0155	69,750	1,465,855
Clemente Contr. Co., Inc.	8.50	32,300	7.25	39,875	3.00	22,500	.055	12,650	5.75	74,750	7.20	741,600	3.00	420,000	.05	37,500	.025	112,500	1,493,675
Frederick Snare Corp.	9.00	34,200	10.00	55,000	2.80	21,000	.05	11,500	4.50	58,500	8.05	829,150	2.70	378,000	.05	37,500	.019	85,500	1,510,350
D. C. Serber, Inc.	11.00	41,800	10.00	55,000	3.25	24,375	.05	11,500	4.50	58,500	7.50	772,500	3.25	455,000	.05	37,500	.013	58,500	1,514,675
The Geo. Colan Constr. Co.	9.50	36,100	10.65	58,575	2.80	21,000	.06	13,800	7.50	97,500	7.90	813,700	2.80	392,000	.06	45,000	.0175	78,750	1,556,425
Silas Mason Co., Inc.	10.00	38,000	18.00	99,000	3.00	22,500	.04	9,200	7.00	91,000	8.25	849,750	3.00	420,000	.04	30,000	.01	45,000	1,604,450
T. A. Gillespie Co.	10.00	38,000	10.00	55,000	3.30	24,750	.05	11,500	10.00	130,000	7.85	808,550	3.30	462,000	.05	37,500	.01	45,000	1,612,300
J. F. Cogan Co., Contractors	10.00	38,000	10.00	55,000	3.75	28,125	.06	13,800	7.50	97,500	8.75	901,250	3.75	525,000	.06	45,000	.0155	69,750	1,773,425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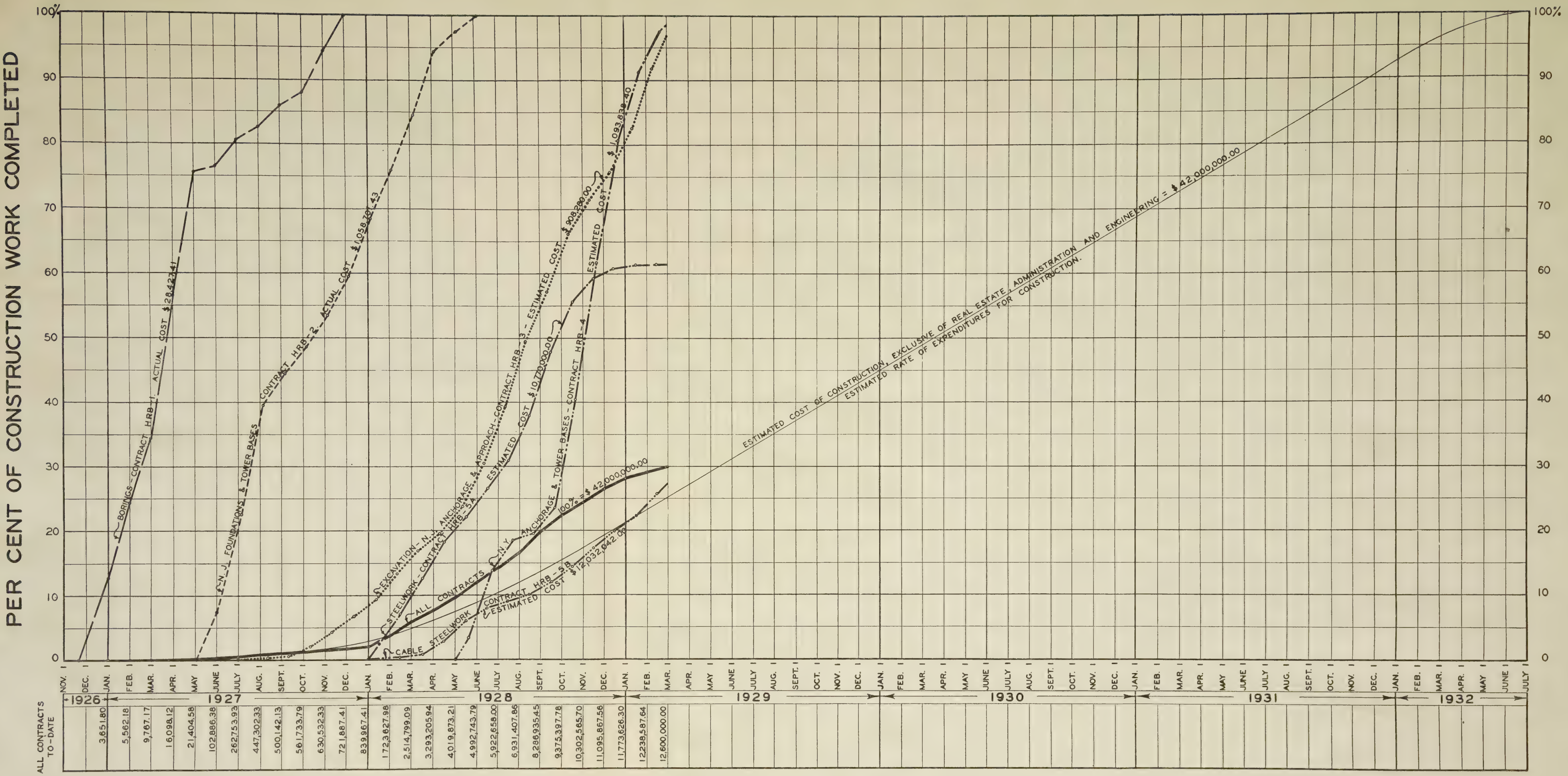

HUDSON RIVER BRIDGE

PROGRESS OF CONSTRUCTION

AS SHOWN BY
MONTHLY PAYMENTS ON EACH CONTRACT
AND BY
TOTAL FOR ALL CONTRACTS.

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